



Office de la Propriété  
Intellectuelle  
du Canada

Un organisme  
d'Industrie Canada

Canadian  
Intellectual Property  
Office

An agency of  
Industry Canada

CA 2292132 C 2005/08/23

(11)(21) **2 292 132**

(12) **BREVET CANADIEN  
CANADIAN PATENT**

(13) **C**

(22) Date de dépôt/Filing Date: 1999/12/08

(41) Mise à la disp. pub./Open to Public Insp.: 2000/06/11

(45) Date de délivrance/Issue Date: 2005/08/23

(30) Priorité/Priority: 1998/12/11 (19857252.2) DE

(51) Cl.Int.<sup>7</sup>/Int.Cl.<sup>7</sup> C07D 307/58, A61K 7/42, A61K 7/06,  
C07D 307/94, C09D 5/32, C08K 5/1535

(72) Inventeurs/Inventors:  
KOCH, OSKAR, DE;  
JOHNCOCK, WILLIAM, DE;  
LANGNER, ROLAND, DE

(73) Propriétaire/Owner:  
SYMRISE GMBH & CO. KG, DE

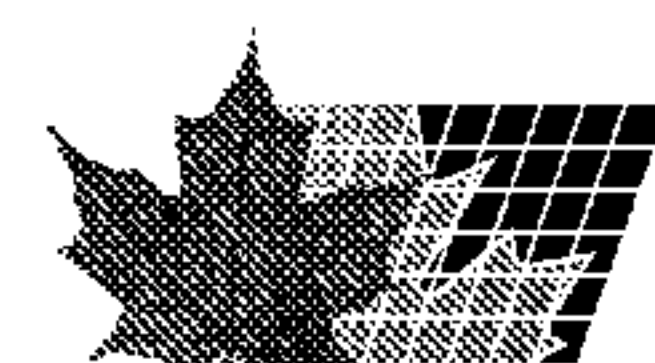
(74) Agent: FETHERSTONHAUGH & CO.

(54) Titre : BENZYLIDENE- $\gamma$ -BUTYROLACTONES, PROCESSUS DE PREPARATION ET LEUR UTILISATION COMME  
ABSORBANT DES UV

(54) Title: BENZYLIDENE- $\gamma$ -BUTYROLACTONES, PROCESS FOR THEIR PREPARATION AND THEIR USE AS UV  
ABSORBER

(57) **Abrégé/Abstract:**

The invention relates to modified benzylidene- $\gamma$ -butyrolactones, to a process for their preparation and to the use as UV absorber, for example in pharmaceutical and cosmetic compositions, sunscreens, daycare and haircare products, for improving industrial products, such as paints, surface coatings, plastics, textiles, packaging materials and rubbers.



**BENZYLIDENE- $\gamma$ -BUTYROLACTONES, PROCESS FOR THEIR PREPARATION AND THEIR USE AS UV ABSORBER**

ABSTRACT OF THE DISCLOSURE

The invention relates to modified benzylidene- $\gamma$ -butyrolactones, to a process for their preparation and to the use as UV absorber, for example in pharmaceutical and cosmetic compositions, sunscreens, daycare and haircare products, for improving industrial products, such as paints, surface coatings, plastics, textiles, packaging materials and rubbers.

**BENZYLIDENE- $\gamma$ -BUTYROLACTONES, PROCESS FOR THEIR PREPARATION AND THEIR USE AS UV ABSORBER**

5

**FIELD OF THE INVENTION**

The invention relates to modified benzylidene- $\gamma$ -butyrolactones, to a process for their preparation and to the use as UV absorber, for example in pharmaceutical and cosmetic compositions, sunscreens, daycare and haircare products, for improving industrial products, such as paints, surface coatings, plastics, textiles, packaging materials and rubbers.

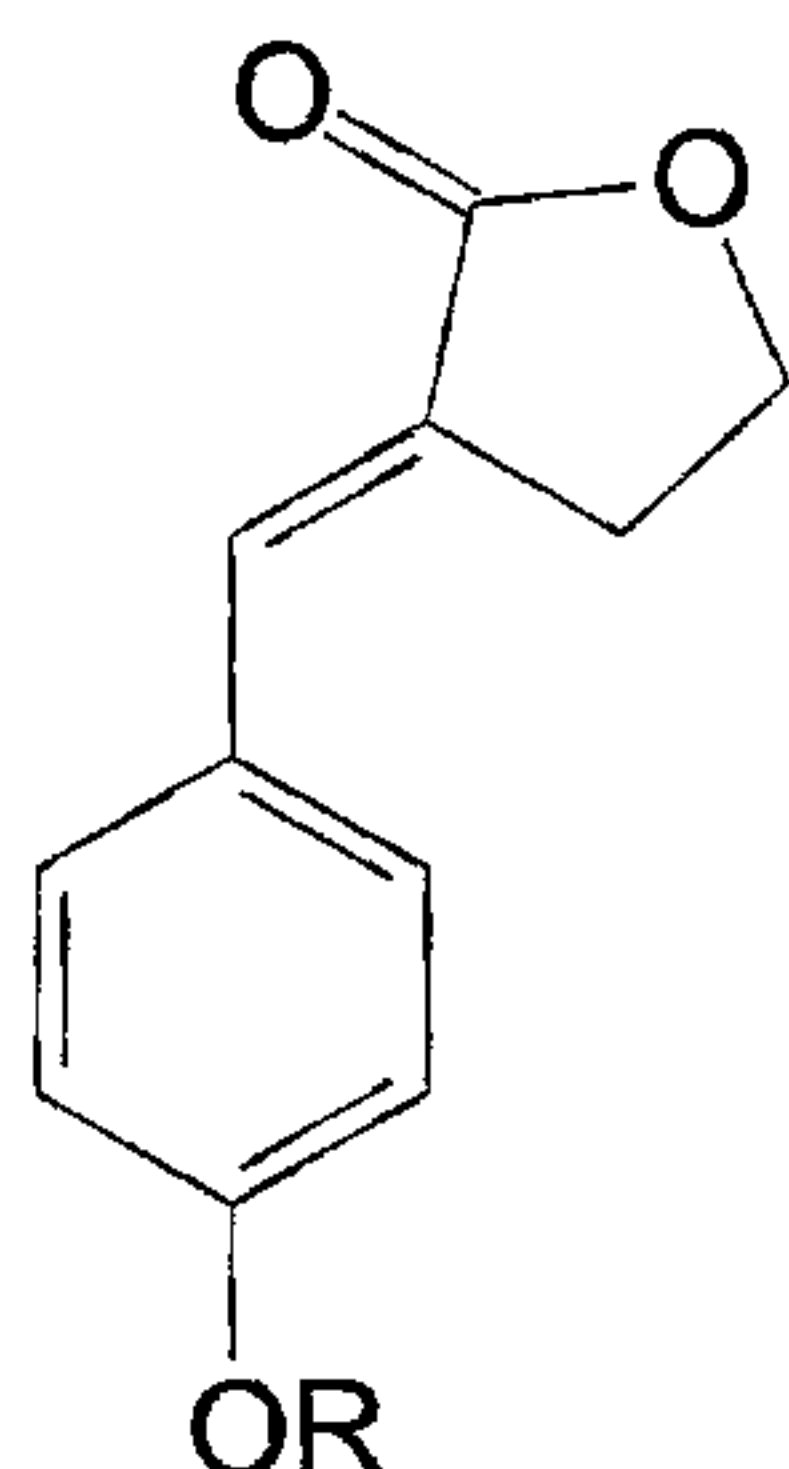
**BACKGROUND OF THE INVENTION**

15 Depending on their wavelength, UV rays are divided into UV-A rays (320-400 nm) and UV-B rays (280-320 nm). The harmful effect, in particular the occurrence of sunburn (erythema), increases not only with the duration of exposure but also with decreasing wavelength and is thus significantly more strongly marked in the case of UV-B radiation than in the case of UV-A radiation. Since erythemas can occur even after short exposure to the sun, in some cases after 20-30 minutes, efficient protection against this radiation is of particular importance.

For this area of UV protection, a number of UV-B absorbers are already known from the prior art. Examples mentioned are camphor derivatives, salicylic acid derivatives, 25 benzophenones, cinnamates, benzimidazoles and triazines. One example of benzylidene- $\gamma$ -butyrolactones is described in European Patent Application EP-A 44970. These are compounds of the formula

27107-14

2



in which

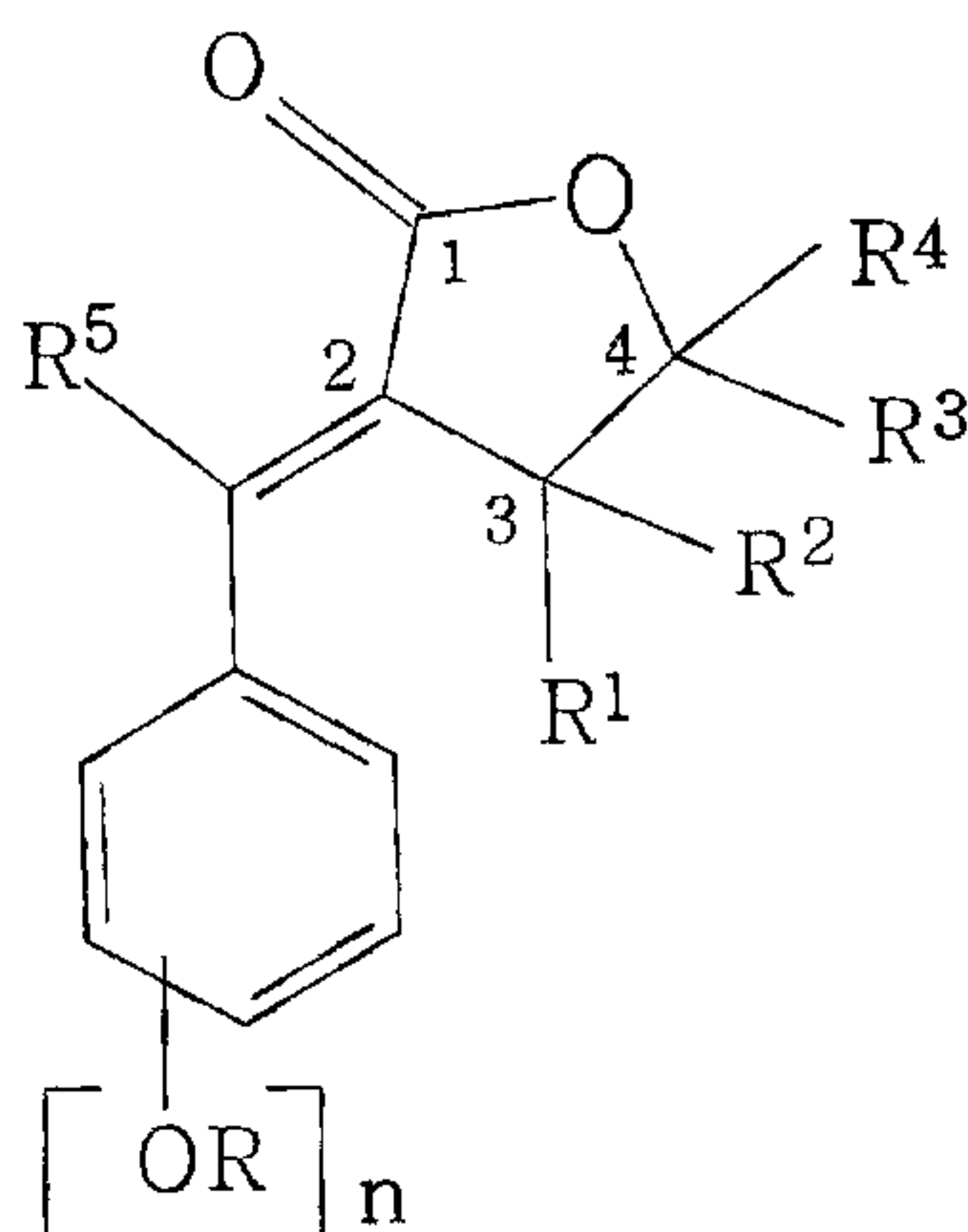
R is a C<sub>1</sub>-C<sub>15</sub>-alkyl radical, branched or unbranched, phenyl or benzyl.

However, all of these compounds have the disadvantages that they are either in the form of a solid and thus have only limited solubility in the cosmetic preparations, exhibit only low absorption or have photostability which does not meet the necessary criteria and are thus unsatisfactory.

10

#### SUMMARY OF THE INVENTION

Accordingly, the object of the present invention is to provide improved UV-B absorbers. This object is achieved by benzylidene- $\gamma$ -butyrolactones of the general formula



15

wherein:

27107-14

3

n is 1, 2 or 3;

R is hydrogen or C<sub>1</sub>-C<sub>6</sub>-alkyl or cycloalkyl, and

R<sup>1</sup> to R<sup>5</sup> independently of one another are hydrogen, but at most four of them are hydrogen at the same time, or  
5 C<sub>1</sub>-C<sub>8</sub>-alkyl or cycloalkyl; or R<sup>1</sup> and R<sup>3</sup> together or R<sup>2</sup> and R<sup>4</sup> together with the carbon atoms to which they are attached, form a carbocyclic ring having 5 to 7 ring atoms, and the remaining groups are each hydrogen or C<sub>1</sub>-C<sub>8</sub>-alkyl or cycloalkyl.

According to the present invention, particular  
10 preference is given to benzylidene- $\gamma$ -butyrolactones in which the lactone ring is trisubstituted at R<sup>1</sup>, R<sup>3</sup> and R<sup>4</sup> by an alkyl, where an alkyl group includes at least one C<sub>2</sub> chain. Likewise preferred are benzylidene- $\gamma$ -butyrolactones whose benzylidene ring is substituted in the paraposition by a methoxy radical,  
15 and R<sup>1</sup> is an ethyl radical, R<sup>2</sup> is hydrogen, and R<sup>3</sup>/R<sup>4</sup> is a methyl radical.

Specific benzylidene- $\gamma$ -butyrolactones compounds of the present invention include: p-methoxybenzylidene-4-methyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-4-butyl- $\gamma$ -butyrolactone,  
20 p-methoxybenzylidene-4,4-dimethyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-3,4-dimethyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-3,4,4-trimethyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-3-methyl-4-pentyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-3-methyl-4-hexyl- $\gamma$ -butyrolactone, o,p-  
25 dimethoxybenzylidene-4-butyl- $\gamma$ -butyrolactone, o,p-dimethoxybenzylide-4,4-dimethyl- $\gamma$ -butyrolactone, o,p-dimethoxybenzylidene-3,4-dimethyl- $\gamma$ -butyrolactone, m,p-dimethoxybenzylidene-4-butyl- $\gamma$ -butyrolactone, m,p-dimethoxybenzylidene-4,4-dimethyl- $\gamma$ -butyrolactone, m,p-

27107-14

3a

dimethoxybenzylidene-3,4-dimethyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-3-ethyl-4,4-dimethyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-3,4-dimethyl-4-butyl- $\gamma$ -butyrolactone, and p-methoxybenzylidene-3,4-dimethyl-4-ethyl- $\gamma$ -butyrolactone.

- 5 Particularly preferred benzylidene- $\gamma$ -butyrolactones include p-methoxy-benzylidene-3-ethyl-4,4-dimethyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-3,4-dimethyl-4-butyl- $\gamma$ -butyrolactone, and p-methoxybenzylidene-3,4-dimethyl-4-ethyl- $\gamma$ -butyrolactone.

The benzylidene- $\gamma$ -butyrolactones according to the present  
10 invention can be prepared in accordance with the prior art by aldol condensation of substituted benzaldehydes,

for example anisaldehyde, with correspondingly substituted  $\gamma$ -butyrolactones, for example  $\beta$ -ethyl- $\gamma,\gamma$ -dimethyl- $\gamma$ -butyrolactone.

5 Additionally, the benzylidene- $\gamma$ -butyrolactones according to the present invention are particularly suitable as UV absorbers and solvents for solid UV absorbers, which have relatively poor solubility within a pharmaceutical or cosmetic preparation. Accordingly, the present invention also provides compositions which comprise the above-mentioned benzylidene- $\gamma$ -butyrolactones and are suitable for protecting against harmful UV radiation. In this connection, the compositions according to the present  
10 invention can comprise one or more of the benzylidene- $\gamma$ -butyrolactones according to the invention.

Preference is given to compositions which comprise from 0.1 to 15% by weight of benzylidene- $\gamma$ -butyrolactones according to the present invention, based on the total  
15 weight of the preparation. Particular preference is given to compositions comprising from 1 to 10% by weight, and most preferably comprising from 2 to 7% by weight, of benzylidene- $\gamma$ -butyrolactone according to the present invention.

According to the present invention, the above-mentioned compositions are preferably  
20 suitable as sunscreens or daycare products for protecting human skin and hair, in particular hair already predamaged by permanent waving, coloring and bleaching, against harmful UV radiation.

According to the present invention, the compositions can also be mixed with  
25 additives known per se and/or known UV absorbers of other classes of substance and/or known pigments.

Examples of common additives are emulsifiers, surface-active compounds, lanolin, petroleum jelly, water, triglycerides of fatty acids, polyethylene glycols, fatty  
30 alcohols, ethoxylated fatty alcohols, fatty acid ester such as, for example, isopropyl palmitate, isooctyl stearate, diisopropyl adipate etc., natural or synthetic oils or

waxes, thickeners, such as, for example, hydroxyethylcellulose, bentonite, etc., preservatives, moisturizers, vitamins, skin-lightening active ingredients such as, for example, hydroquinones, arbutin, kojic acid and derivatives, ascorbic acid and derivatives, glutathione, hydroxybenzaldoximes, e.g., 4-hydroxy-3-methoxybenzaldehyde oxime, antioxidants such as, for example, BHT, vitamin derivatives, catechol derivatives, e.g., epigallocatechol gallate or 3,4-dihydroxybenzaldehyde oxime, complexing agents such as, for example, EDTA and derivatives, insect repellents such as, for example, DEET or IR 3535, silicone oils, glycerol, ethyl alcohol and perfume oils. The list of additives is not limited to the examples given.

Pigments which can be added are, for example, titanium dioxide, zinc oxide, pearlizing pigments or color pigments.

Examples of traditional UV absorbers include p-aminobenzoic acid, ethyl p-aminobenzoate (25 mol) ethoxylated, 2-ethylhexyl p-dimethyl-aminobenzoate, ethyl p-aminobenzoate (2 mol) N-propoxylated, glycerol p-aminobenzoate, homomenthyl salicylate, 2-ethylhexyl salicylate, triethanolamine salicylate, 4-isopropylbenzyl salicylate, methyl anthranilate, ethyl diisopropylcinnamate, 2-ethylhexyl p-methoxycinnamate, methyl diisopropylcinnamate, isoamyl p-methoxycinnamate, p-methoxycinnamic acid diethanolamine salt, isopropyl p-methoxycinnamate, 2-ethylhexyl 2-cyano-3,3-diphenyl acrylate, ethyl 2-cyano-3,3'-diphenyl acrylate, 2-phenylbenzimidazolesulphonic acid and salts, 3-(4'-trimethylammonium)-benzylidenebornan-2-one methylsulphate, terephthalylidene-dibornanesulphonic acid and salts, 4-t-butyl-4'-methoxydibenzoylmethane,  $\beta$ -imidazole-4(5)-acrylic acid (urocanic acid), 2-hydroxy-4-methoxybenzophenone, 2-hydroxy-4-methoxybenzophenone-5-sulphonic acid, dihydroxy-4-methoxybenzophenone, 2,4-dihydroxybenzophenone, tetrahydroxybenzophenone, 2,2'-dihydroxy-4,4'-dimethoxybenzophenone, 2-hydroxy-4-n-octoxybenzophenone, 2-hydroxy-4-methoxy-4'-methylbenzophenone, 3-(4'sulpho)benzylidene-bornan-2-one and salts, 3-(4'-methylbenzylidene)-d,1 camphor, 3-benzylidene-d,1-camphor, 4-isopropylidibenzoylmethane, 2,4,6-trianilino-(p-carboxy-2'-ethylhexyl-1'-oxy)-1,3,5-triazine, phenylene-bis-benzimidazol-tetrasulphonic acid disodium salt and N-[(2 and 4)-[2-(oxoborn-3ylidene)methyl]benzyl]-acrylamide

polymer, benzylidene malonate polymer, 2,2'-methylene-bis-(6-(2H-benzotriazol-2-yl)-4-(1,1,3,3-tetramethylbutyl)-phenol), 2,2'-(1,4-phenylene)bis-1H-benzimidazol-4,6-disulphonic acid, monosodium salt, 2,4-bis-((4-(2-ethyl-hexyloxy)-2-hydroxy)-phenyl)-6-(4-methoxyphenyl)-(1,3,5)-triazine.

5

UV absorbers which have proven to be particularly suitable for combination with the agents according to the present invention are 2-ethylhexyl p-methoxycinnamate, isoamyl p-methoxycinnamate, 2-phenylbenzimidazolesulphonic acid, 3-(4'-methylbenzylidene)-d,1-camphor, 2-ethylhexyl 2-cyano-3,3-diphenylacrylate, 2-ethylhexyl  
10 salicylate, 4-tert-butyl-4'-methoxydibenzoylmethane and phenylene-bis-benzimidazol-tetrasulphonic acid disodium salt, indanylidene derivatives according to DE 19 631 863 and benzazol derivatives according to DE 19 648 010.

The present invention further provides for the use of the agents according to the  
15 present invention in combination with conventional UV absorbers for enhancing the protection against harmful UV radiation above the degree of protection which is achieved using equal amounts of conventional UV absorbers alone or the agents alone (synergistic effect).

20 Furthermore, the agents according to the present invention can also be combined with conventional UV absorbers which are used for the protection of industrial products, such as paints, surface coatings, plastics, textiles, packaging materials or rubber.

Examples of such UV absorbers are compounds from the group consisting of  
25 benzotriazoles, benzophenones, triazines, cinnamic esters and oxalanilides.

The compositions according to the present invention can be in the form of any currently customary cosmetic or pharmaceutical preparations. For example, they can be supplied as emulsion, milk, lotion, cream, gel, aerosol, shampoo, conditioner,  
30 intensive conditioner or spray.

- 7 -

Surprisingly, the compositions which comprise benzylidene- $\gamma$ -butyrolactone in accordance with the present invention are characterized by a combination of desirable properties.

5     The agents have the advantageous properties according to the present invention in that they have high UV protection even at low use concentrations, excellent photo-stability and thermal stability and good solubility in cosmetic solvents. In addition, the crystalline, oil-soluble UV absorbers have, in accordance with the present invention, excellent solubility in cosmetic solvents. The agents have, in accordance  
10    with the invention, good compatibility with cosmetic bases and good pH stability, are colorless, neutral in odor and water-resistant. In addition, the agents according to the present invention can be incorporated without problems into cosmetic preparations and exhibit good stability under use conditions and good compatibility with packaging materials. Moreover, the compositions according to the present invention  
15    do not cause any discoloration of textiles and can be washed out easily.

The application is illustrated in more detail below by reference to the examples:

**EXAMPLES****1. Benzylidene- $\gamma$ -butyrolactones according to the present invention and their preparation**

5

By way of example for the preparation of the benzylidene- $\gamma$ -butyrolactones according to the invention, the preparation of p-methoxybenzylidene-4-methyl- $\gamma$ -butyrolactone as Example 1 may be illustrated in more detail.

10

**Example 1: p-Methoxybenzylidene-4-methyl- $\gamma$ -butyrolactone**

74 g (0.5 mol) of 4-methyl- $\gamma$ -butyrolactone are added to a suspension of 27 g (0.50 mol) of sodium methoxide in 400 g of methyl tert-butyl ether and, over the course of 1 h, 68 g (0.5 mol) of anisaldehyde are added thereto with stirring at room temperature. The mixture is maintained under reflux for a further 1 h and then cooled, and 200 g of iced water are added to the mixture and the pH is adjusted to 5 using 10% sulphuric acid. After the phases have separated, the product is distilled. This gives 65 g of the desired compound in a yield of 48% of theory. The specific absorbance  $E^{1/1}$  of the novel compound according to the present invention is 1.250, measured at a wavelength of  $\lambda_{\max}$  310 nm.

20

**Example 2: p-Methoxybenzylidene-4,4-dimethyl- $\gamma$ -butyrolactone**

Analogous process using 4,4-dimethyl- $\gamma$ -butyrolactone.  $E^{1/1}$  1.200 ( $\lambda_{\max}$  310 nm).

25

**Example 3: p-Methoxybenzylidene-3,4-dimethyl- $\gamma$ -butyrolactone**

Analogous process using 3,4-dimethyl- $\gamma$ -butyrolactone.  $E^{1/1}$  1.050 ( $\lambda_{\max}$  314 nm).

**Example 4: p-Methoxybenzylidene-3,4,4-trimethyl- $\gamma$ -butyrolactone**

Analogous process using 3,4,4-trimethyl- $\gamma$ -butyrolactone.  $E^{1/1}$  1.060 ( $\lambda_{\max}$  312 nm).

30

**Example 5:** p-Methoxybenzylidene-3-ethyl-4,4-dimethyl- $\gamma$ -butyrolactone

Analogous process using 3-ethyl-4,4-dimethyl- $\gamma$ -butyrolactone.  $E'_{1/1}$  940 ( $\lambda_{\max}$  312 nm).

**Example 6:** p-Methoxybenzylidene-3-methyl-4-pentyl- $\gamma$ -butyrolactone

5 Analogous process using 3-methyl-4-pentyl- $\gamma$ -butyrolactone.  $E'_{1/1}$  830 ( $\lambda_{\max}$  313 nm).

**Example 7:** p-Methoxybenzylidene-3,4-dimethyl-4-butyl- $\gamma$ -butyrolactone

Analogous process using 3,4-dimethyl-4-butyl- $\gamma$ -butyrolactone.  $E'_{1/1}$  810 ( $\lambda_{\max}$  312 nm).

10 **Example 8:** p-Methoxybenzylidene-3,4-dimethyl-4-ethyl- $\gamma$ -butyrolactone

Analogous process using 3,4-dimethyl-4-ethyl- $\gamma$ -butyrolactone.  $E'_{1/1}$  960 ( $\lambda_{\max}$  311 nm).

15 2. **Compositions according to the present invention, their preparation and  
determination of the sun protection factor:**

20 The composition and the preparation procedure for various sunscreens according to the present invention are listed in Examples 9 to 14. In this connection, (O/W) indicates that it is an oil-in-water emulsion. The abbreviation (W/O) indicates a water-in-oil emulsion. Example 15 describes the composition and preparation of a sunscreen oil, Example 16 a sunscreen cream or a sunscreen gel, and Example 17 discloses the constituents and preparations of a hair shampoo according to the present invention.

27107-14

-10-

**Example 9****Sunscreen lotion (O/W)**5 **PREPARATION PROCEDURE:**

Part A: Melt at about 80°C

Part B: Heat to about 90°C, add Part B to Part A with stirring.

Part C: Disperse Carbopol\* in water until lump-free, neutralize the sodium hydroxide solution to give a gel, add to Part A/B at about 60°C.

10 Stir until the temperature drops to room temperature.

Part D: Perfume the emulsion at about 30°C, check the pH (6.5 to 7.0).

**TABLE 1**

|    | CONSTITUENTS                                                                                | %     |
|----|---------------------------------------------------------------------------------------------|-------|
| A) | Arlatone*983 S                                                                              | 1.75  |
|    | Brij*76                                                                                     | 1.25  |
|    | Lanette*O                                                                                   | 1.15  |
|    | Myritol*318                                                                                 | 15.00 |
|    | Cetiol*SN                                                                                   | 15.00 |
|    | Phenonip*                                                                                   | 0.20  |
|    | UV absorber<br>p-Methoxybenzyliden-3,4-dimethyl-4-ethyl- $\gamma$ -butyrolactone<br>1 - 10% | 5.00  |
| B) | Water, dist.                                                                                | 31.65 |
|    | 1,2-Propylene glycol                                                                        | 2.00  |
|    | Phenonip*                                                                                   | 0.30  |
| C) | Water, dist.                                                                                | 25.00 |
|    | Carbopol*2984                                                                               | 0.30  |
|    | Sodium hydroxide, 10% in water                                                              | 1.00  |
| D) | Perfume oil                                                                                 | 0.40  |

\* Trade-mark

27107-14

-11-

**Example 10****Sunscreen milk (W/O)**

5

**PREPARATION PROCEDURE:**

Part A: Thorough melt at about 90°C.

Part B: Heat to about 95°C, then add Part B to Part A with stirring. Stir until the temperature drops to room temperature.

10 Part C: Add Part C at 30°C and then homogenize.

**TABLE 2**

|    | CONSTITUENTS                                                                     | %     |
|----|----------------------------------------------------------------------------------|-------|
| A) | Dehymuls*PG PH                                                                   | 5.00  |
|    | Permulin*3220                                                                    | 0.50  |
|    | Zinc stearate                                                                    | 0.50  |
|    | Myritol*318                                                                      | 15.00 |
|    | Cetiol*SN                                                                        | 15.00 |
|    | UV absorber<br>p-Methoxybenzyliden-3,4-dimethyl-4-ethyl- $\gamma$ -butyrolactone | 5.00  |
| B) | Water, dist.                                                                     | 52.50 |
|    | Glycerol 86%                                                                     | 5.00  |
|    | Magnesium sulphate 7 H <sub>2</sub> O                                            | 0.50  |
|    | Phenonip*                                                                        | 0.50  |
| C) | Perfume oil                                                                      | 0.50  |

\* Trade-mark

27107-14

-12-

**Example 11****Sunscreen lotion (O/W)**

## 5 PREPARATION PROCEDURE:

Part A: Melt at about 80°C

Part B: Heat at about 90°C. Add Part B to Part A with stirring.

10 Part C: Disperse Carbopol\* in water until lump-free, neutralize with sodium hydroxide solution to give a gel, add to Part A/B at about 60°C. Stir until the temperature drops to room temperature.

Part D: Perfume the emulsion at about 30°C, check the pH (6.5 to 7.0).

**TABLE 3**

|    | CONSTITUENTS                                                            | %     |
|----|-------------------------------------------------------------------------|-------|
| A) | Arlatone*983 S                                                          | 1.75  |
|    | Brij*76                                                                 | 1.25  |
|    | Lanette* O                                                              | 1.15  |
|    | Myritol* 318                                                            | 15.00 |
|    | Cetiol*SN                                                               | 15.00 |
|    | Finsolv*TN                                                              | 5.00  |
|    | Phenonip*                                                               | 0.20  |
|    | UV absorber<br>p-Methoxybenzyliden-3,4-dimethyl-4-ethyl-γ-butyrolactone | 4.00  |
|    | Parsol* 1789                                                            | 1.50  |
| B) | Water, dist.                                                            | 26.15 |
|    | 1,2-Propylene glycol                                                    | 2.00  |
|    | Phenonip*                                                               | 0.30  |
| C) | Water, dist.                                                            | 25.00 |
|    | Carbopol*2984                                                           | 0.30  |
|    | Sodium hydroxide, 10% strength in water                                 | 1.00  |
| D) | Perfume oil                                                             | 0.40  |

\* Trade-mark

27107-14

-13-

**Example 12****Sunscreen lotion (O/W)**

5

**PREPARATION PROCEDURE:**

Part A: Melt at about 80°C

Part B: Heat at about 90°C. Add Part B to Part A with stirring.

- 10 Part C: Disperse Carbopol\* in water until lump-free, neutralize with sodium hydroxide solution to give a gel, add to Part A/B at about 60°C. Stir until the temperature drops to room temperature.

Part D: Perfume the emulsion at about 30°C, check the pH (6.5 to 7.0).

15

**TABLE 4**

|    | CONSTITUENTS                                                                     | %     |
|----|----------------------------------------------------------------------------------|-------|
| A) | Arlatone*983 S                                                                   | 1.75  |
|    | Brij*76                                                                          | 1.25  |
|    | Lanette*O                                                                        | 1.15  |
|    | Myritol*318                                                                      | 12.00 |
|    | Cetiol*SN                                                                        | 12.00 |
|    | UV absorber<br>p-Methoxybenzyliden-3,4-dimethyl-4-ethyl- $\gamma$ -butyrolactone | 7.00  |
|    | NEO HELIOPAN® E 1000                                                             | 7.00  |
|    | Phenonip*                                                                        | 0.20  |
| B) | Water, dist.                                                                     | 28.65 |
|    | 1,2-Propylene glycol                                                             | 2.00  |
|    | Phenonip*                                                                        | 0.30  |
| C) | Water, dist.                                                                     | 25.00 |
|    | Carbopol*2984                                                                    | 0.30  |
|    | Sodium hydroxide, 10% strength in water                                          | 1.00  |
| D) | Perfume oil                                                                      | 0.40  |

\* Trade-mark

27107-14

-14-

**Example 13****Sunscreen lotion (O/W)**5 **PREPARATION PROCEDURE:**

Part A: Melt at about 80°C, then thoroughly disperse Eusolex TA.

Part B: Heat to about 90°C without Veegum\* and Natrosol\*, then disperse Veegum\* and Natrosol\*, add Part B to Part A with stirring. Stir until the temperature drops to room temperature.

10 Part C: Add Part C at 30°C and then homogenize.

Check the pH (7.0-7.5).

**TABLE 5**

|    | CONSTITUENTS                                                                                                                                                                | %     |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| A) | Arlacel*165                                                                                                                                                                 | 3.00  |
|    | Eumulgin*B 2                                                                                                                                                                | 1.00  |
|    | Lanette*                                                                                                                                                                    | 1.00  |
|    | Myritol*318                                                                                                                                                                 | 4.00  |
|    | Cetiol*OE                                                                                                                                                                   | 2.00  |
|    | Abil*100                                                                                                                                                                    | 1.00  |
|    | Bentone Gel MIO*                                                                                                                                                            | 3.00  |
|    | Cutina CBS*                                                                                                                                                                 | 1.00  |
|    | Phenonip*                                                                                                                                                                   | 0.20  |
|    | NEO HELIOPAN® OS (octyl salicylate)                                                                                                                                         | 3.00  |
|    | NEO HELIOPAN® AV (octyl methoxycinnamate)                                                                                                                                   | 5.00  |
|    | NEO HELIOPAN® E 1000 (isoamyl p-methoxycinnamate)                                                                                                                           | 5.00  |
|    | NEO HELIOPAN® MBC(4-methylbenzylidene camphor)                                                                                                                              | 1.00  |
|    | Eusolex*TA                                                                                                                                                                  | 3.00  |
|    | UV absorber p-Methoxybenzyliden-3,4-dimethyl-4-ethyl-γ-butyrolactone                                                                                                        | 3.00  |
| B) | Water, dist.                                                                                                                                                                | 45.60 |
|    | Glycerol, 86% strength                                                                                                                                                      | 3.00  |
|    | Phenonip*                                                                                                                                                                   | 0.30  |
|    | Veegum*Ultra                                                                                                                                                                | 1.00  |
|    | Natrosol*250 HHR                                                                                                                                                            | 0.30  |
|    | NEO HELIOPAN® HYDRO, used as a 15% strength solution after neutralization with sodium hydroxide (phenyl benzimidazole sulphonic acid) corresponds to active substance: 2.0% | 13.30 |
| C) | Perfume oil                                                                                                                                                                 | 0.30  |

\* Trade-mark

27107-14

-15-

**Example 14****Sunscreen lotion (W/O)**

5

**PREPARATION PROCEDURE:**

Part A: Thoroughly melt at about 90°C (without ZINKOXID NEUTRAL\* H&R).

Then thoroughly disperse ZINKOXID NEUTRAL\* H&R.

10

Part B: Heat to about 95°C, then add Part B to Part A with stirring. Stir until the temperature drops to room temperature.

Part C: Add Part C at 30°C and then homogenize.

**TABLE 6**

|    | CONSTITUENTS                                                         | %     |
|----|----------------------------------------------------------------------|-------|
| A) | Arlacel*1689                                                         | 3.50  |
|    | Finsolv*TN                                                           | 6.00  |
|    | NEO HELIOPAN® E 1000 (isoamyl p-methoxycinnamate)                    | 7.00  |
|    | Uvinul*T 150 (octyl triazone)                                        | 1.00  |
|    | UV absorber p-Methoxybenzyliden-3,4-dimethyl-4-ethyl-γ-butyrolactone | 3.00  |
|    | Copherol*F 1250                                                      | 2.00  |
|    | Permulin*2550                                                        | 1.00  |
|    | Myritol*318                                                          | 6.00  |
|    | Cetiol*SN                                                            | 6.00  |
|    | ZINKOXID NEUTRAL* H&R (zinc oxide)                                   | 7.00  |
| B) | Water, dist.                                                         | 51.70 |
|    | Glycerol 86% strength                                                | 5.00  |
|    | Phenonip*                                                            | 0.50  |
| C) | Perfume oil                                                          | 0.30  |

\* Trade-mark

27107-14

-16-

**Example 15****Sunscreen oil**

5

**PREPARATION PROCEDURE:**

Thoroughly mix all constituents.

**TABLE 7**

10

|    | CONSTITUENTS                                                                     | %     |
|----|----------------------------------------------------------------------------------|-------|
| A) | NEO HELIOPAN <sup>®</sup> E 1000 (isoamyl p-methoxycinnamate)                    | 7.50  |
|    | NEO HELIOPAN <sup>®</sup> OS (octyl salicylate)                                  | 5.00  |
|    | UV absorber<br>p-Methoxybenzyliden-3,4-dimethyl-4-ethyl- $\gamma$ -butyrolactone | 3.00  |
|    | Myritol*318                                                                      | 34.70 |
|    | Diisopropyl adipate                                                              | 5.00  |
|    | Olive oil                                                                        | 1.00  |
|    | Jobba oil                                                                        | 1.00  |
|    | Macadamia nut oil                                                                | 1.00  |
|    | Tocopherol oil                                                                   | 1.00  |
|    | Isopropyl myristate                                                              | 35.00 |
|    | Antaron*V-216                                                                    | 5.00  |
|    | Phenonip*                                                                        | 0.50  |
|    | Perfume oil                                                                      | 0.30  |

\* Trade-mark

27107-14

-17-

**Example 16****Sunscreen cream gel**5 **PREPARATION PROCEDURE:**

Part A: Dissolve ingredients in the water.

Part B: Mix all constituents (without Permulen\* and Carbopol\*). Dissolve  
 NEO HELIOPAN® MBC and UV absorber according to formula (I) with  
 gentle warming. Disperse Carbopol\* and Permulen\*. Then add Part B to Part  
 10 A and mix vigorously for 45 minutes.

Part C: Add triethanolamine to Part A/B with stirring. Continue stirring until the  
 product is homogeneous. Check the pH (about 7.0).

**TABLE 8**

15

|    | CONSTITUENTS                                                            | %     |
|----|-------------------------------------------------------------------------|-------|
| A) | Water, dist.                                                            | 75.35 |
|    | Phenonip*                                                               | 0.50  |
|    | EDTA B liquid                                                           | 0.10  |
| B) | NEO HELIOPAN® AV (octyl methoxycinnamate)                               | 7.00  |
|    | NEO HELIOPAN® 303 (octocrylene)                                         | 3.00  |
|    | NEO HELIOPAN® MBC (4-methylbenzylidene camphor)                         | 1.00  |
|    | UV absorber<br>p-Methoxybenzyliden-3,4-dimethyl-4-ethyl-γ-butyrolactone | 3.00  |
|    | Cetiol*SN                                                               | 5.00  |
|    | Eutanol*G                                                               | 3.00  |
|    | Lameform*TG I                                                           | 1.00  |
|    | Perfume oil                                                             | 0.30  |
|    | Permulen*TR-1                                                           | 0.25  |
|    | Carbopol*954                                                            | 0.05  |
| C) | Triethanolamine                                                         | 0.45  |

\* Trade-mark

27107-14

-18-

**Example 17****Hair shampoo**

- 5      Part A:      Dissolve UV absorber in NEO HELIOPAN<sup>®</sup> E 1000 and Phenonip\* and with gentle warming, then add Arlatone\*G and perfume oil and mix well. Weigh in the remaining constituents.
- 10      Part B:      Dissolve polymer in the water with stirring, and add and dissolve the remaining constituents. Add Part B to Part A and stir (check the pH, about 5.5).

**TABLE 9**

|                               | CONSTITUENTS                                                                     | %     |
|-------------------------------|----------------------------------------------------------------------------------|-------|
| A)                            | Genapol*LRO liquid                                                               | 18.00 |
|                               | Texapon*MG 3                                                                     | 36.00 |
|                               | Lamepon*S                                                                        | 6.00  |
|                               | Perfume oil                                                                      | 0.60  |
|                               | Phenonip*                                                                        | 0.50  |
|                               | Arlatone*G                                                                       | 2.00  |
|                               | UV absorber<br>p-Methoxybenzyliden-3,4-dimethyl-4-ethyl- $\gamma$ -butyrolactone | 0.50  |
| B)                            | Water, dist.                                                                     | 34.00 |
|                               | Polymer JR 400                                                                   | 0.20  |
|                               | D-Panthenol                                                                      | 1.00  |
|                               | Sodium chloride                                                                  | 1.00  |
|                               | Sodium hydroxide, 10% strength in water                                          | 0.20  |
| <b>PREPARATION PROCEDURE:</b> |                                                                                  |       |

\* Trade-mark

27107-14

-19-

3. Commercially available substances used to prepare the compositions according to the invention:

5 The commercially available substances used in Point 2 to prepare the compositions according to the invention, and their suppliers are summarized below:

**TABLE 10**

| Trade name            | Chemical name                                                                 | Supplier |
|-----------------------|-------------------------------------------------------------------------------|----------|
| Abil*100              | Polydimethylsiloxane                                                          | 7        |
| Antaron*V-216         | Vinylpyrrolidone/hexadecene copolymer                                         | 18       |
| Arlacel*1689          | Sorbitan monooleate/propylglyceryl-3-ricinoleate                              | 4        |
| Arlacel*165           | Glycerol stearate/polyethylene glycol (MW 100) stearate mixture               | 4        |
| Arlatone*G            | hydrogenated with 25 mol of ethylene oxide                                    | 4        |
| Arlatone*983 S        | Polyethylene glycol (MW 5) glyceryl stearate                                  | 4        |
| Baysilone*Fluid PK 20 | Silicone oil                                                                  | 5        |
| Betone Gel MIO*       | Mineral oil, quaternium-18 hectorite, propylene carbonate                     | 17       |
| Brij*76               | Polyethylene glycol (MW 10) stearyl ether                                     | 4        |
| Carbopol*2984         | Polyacrylic acid                                                              | 2        |
| Carbopol*954          | Polyacrylic acid                                                              | 2        |
| Cetiol*HE             | Polyol fatty acid ester                                                       | 3        |
| Cetiol* OE            | Dicaprylyl ether                                                              | 3        |
| Cetiol*SN             | Cetyl/stearyl isononanoate                                                    | 3        |
| Copherol*F 1250       | D- $\alpha$ -Tocopheryl acetate                                               | 3        |
| Cutina CBS*           | Glycerol stearate, cetyl/stearyl alcohol, cetyl palmitate, coconut glycerides | 3        |
| Dehymuls*PG PH        | Polyglycerol poly-12-hydroxystearate                                          | 3        |
| Diisopropyl adipate   | Diisopropyl adipate                                                           | 3        |
| D-Panthenol           | Panthothenyl alcohol                                                          | 15       |

\*Trade-mark

27107-14

-20-

| Trade name          | Chemical name                                                   | Supplier |
|---------------------|-----------------------------------------------------------------|----------|
| EDTA B liq.         | Tetrasodium ethylenediaminetetraacetic acid                     | 6        |
| Eusolex*TA          | Titanium dioxide                                                | 13       |
| Eutanol*G           | 2-Octyldodecanol                                                | 3        |
| Eumulgin*B2         | Cetyl/stearyl alcohol, etherified with 20 mol of ethylene oxide | 3        |
| Finsolv*TN          | Alkyl benzoate                                                  | 23       |
| Genapol*LRO liq.    | Sodium lauryl sulphate                                          | 9        |
| Glycerol            | 1,2,3-Propanetriol                                              | 3        |
| Isopropyl myristate | Isopropyl myristate                                             | 3        |
| Jojoba oil          | Jojoba oil                                                      | 19       |
| Lameform*TGI        | Triglycerol diisostearate                                       | 3        |
| Lamepon*S           | Protein/coconut fatty acid condensate, potassium salt           | 3        |
| Lanette*O           | Cetyl/stearyl alcohol mixture                                   | 3        |
| Macadamia nut oil   | Macadamia nut oil                                               | 20       |
| Myritol*318         | Capryl/capric triglyceride                                      | 3        |
| Natrosol*250 HHR    | Hydroxyethylcellulose                                           | 11       |
| NEO HELIOPAN®AV     | Isooctyl p-methoxycinnamate                                     | 1        |
| NEO HELIOPAN®BB     | 2-Hydroxy-4-methoxybenzophenone                                 | 1        |
| NEO HELIOPAN®E 1000 | Isoamyl p-methoxycinnamate                                      | 1        |
| NEO HELIOPAN®HYDRO  | Phenylbenzimidazolesulphonic acid                               | 1        |
| NEO HELIOPAN®MBC    | 3-(4-Methylbenzylidene)-d, l-camphor                            | 1        |
| NEO HELIOPAN®OS     | 1-Ethylhexyl salicylate                                         | 1        |
| NEO HELIOPAN®303    | Isooctyl $\alpha$ -phenyl- $\beta$ -cyanocinnamate              | 1        |
| Olive oil           | Olive oil                                                       | 21       |
| Parsol*1789         | Butylmethoxydibenzoylmethane                                    | 12       |
| Permulin*2550       | Wax                                                             | 14       |
| Permulin*3220       | Wax                                                             | 14       |
| Permulin*TR 1       | Polyacrylate                                                    | 2        |

\* Trade-mark

27107-14

-21-

| Trade name                | Chemical name                                             | Supplier |
|---------------------------|-----------------------------------------------------------|----------|
| Phenonip*                 | Mixture of p-hydroxybenzoic esters and phenoxyethanol     | 8        |
| Polymer JR 400            | Polyquaternium-10                                         | 21       |
| 1,2-Propylene glycol      | 1,2-Propanediol                                           | 6        |
| Texapon*MG 3              | Magnesium lauryl sulphate/disodium lauryl sulphosuccinate | 3        |
| Tocopherol oil            | Soya oil with D- $\alpha$ -tocopherol                     | 22       |
| Uvinul* T 150             | Isooctyl triazinyl-p-aminobenzoate                        | 6        |
| Veegum* Ultra             | Magnesium aluminium silicate                              | 10       |
| ZINC OXIDE NEUTRAL<br>H&R | Zinc oxide                                                | 1        |
| Zinc stearate             | Zinc stearate                                             | 16       |

\* Trade-mark

**Suppliers****TABLE 11**

|     |                                                   |
|-----|---------------------------------------------------|
| 1.  | Haarmann & Reimer GmbH, Holzminden                |
| 2.  | B.F. Goodrich Company, Neuss                      |
| 3.  | Henkel KGaA, Düsseldorf                           |
| 4.  | ICI Speciality Chemicals, Frankfurt               |
| 5.  | Bayer AG, Leverkusen                              |
| 6.  | BASF, Ludwigshafen                                |
| 7.  | Goldschmidt AG, Essen                             |
| 8.  | Nipa Lab. Ltd., Pontypridd Mid Glam., Wales / GB  |
| 9.  | Hoechst AG, Frankfurt                             |
| 10. | R.T. Vanderbilt Company Inc., Norwalk / USA       |
| 11. | Hercules Inc., Wilmington, Delaware/USA           |
| 12. | Hoffmann-LaRoche, Basle/CH                        |
| 13. | E. Merck, Darmstadt                               |
| 14. | Koster Keunen Holland BV, Bladl /NL               |
| 15. | Akzo Chemie GmbH, Düren                           |
| 16. | Chemische Werke Bärlocher, Munich                 |
| 17. | Rheox Inc., Hightstown, New Jersey / USA          |
| 18. | ISP Global Technologies Deutschland GmbH, Frechen |
| 19. | Henry Lamotte, Bremen                             |
| 20. | Erhard Wagner GmbH, Bremen                        |
| 21. | Nordmann & Rassmann GmbH & Co., Hamburg           |
| 22. | Richter GmbH, Berlin                              |
| 23. | Witco Surfactants GmbH, Steinau a.d. Straße       |

Although the invention has been described in detail in the foregoing for the purpose of illustration, it is to be understood that such detail is solely for that purpose and that

- 23 -

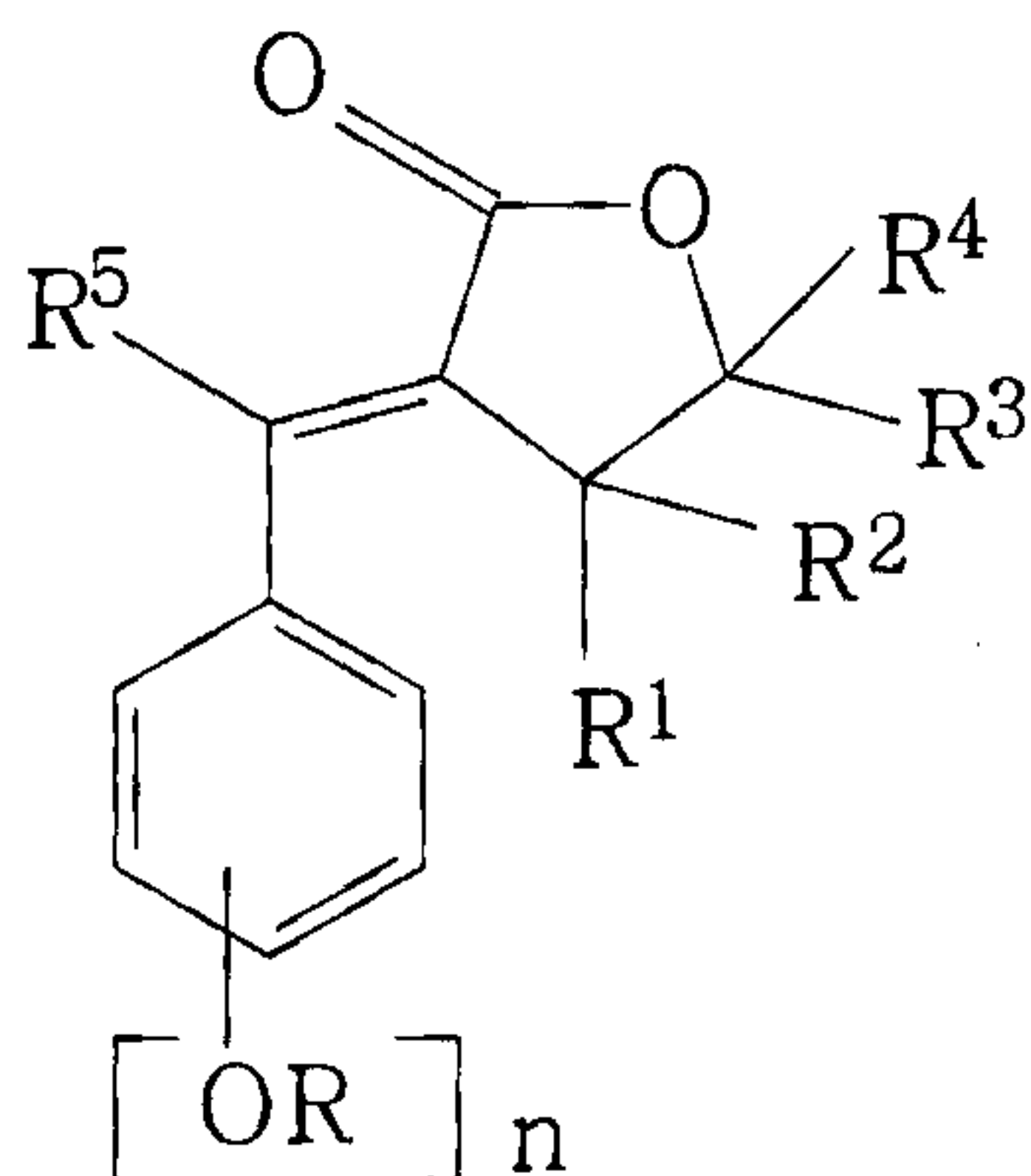
variations can be made therein by those skilled in the art without departing from the spirit and scope of the invention except as it may be limited by the claims.

27107-14

24

CLAIMS:

1. A benzylidene- $\gamma$ -butyrolactone of the general formula:



5 wherein:

n is 1, 2 or 3;

R is hydrogen or C<sub>1</sub>-C<sub>6</sub>-alkyl or cycloalkyl, and

10 R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup>, R<sup>4</sup> and R<sup>5</sup> independently of one another are each hydrogen or C<sub>1</sub>-C<sub>8</sub>-alkyl or cycloalkyl; or R<sup>1</sup> and R<sup>3</sup> together or R<sup>2</sup> and R<sup>4</sup> together with the carbon atoms to which they are attached form a carbocyclic ring having 5 to 7 ring atoms, and the remaining groups are each hydrogen or C<sub>1</sub>-C<sub>8</sub>-alkyl or cycloalkyl,

15 provided that at most four of R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup>, R<sup>4</sup> and R<sup>5</sup> are hydrogen at the same time.

2. The benzylidene- $\gamma$ -butyrolactone according to claim 1, wherein R<sup>1</sup>, R<sup>3</sup> and R<sup>4</sup> are each a C<sub>1</sub>-C<sub>8</sub>-alkyl and R<sup>2</sup> and R<sup>5</sup> are each hydrogen or C<sub>1</sub>-C<sub>8</sub>-alkyl.

20 3. The benzylidene- $\gamma$ -butyrolactone according to claim 1, wherein n is 1; OR is a methoxy group in the para-position; R<sup>1</sup>

27107-14

25

is ethyl;  $R^2$  is hydrogen; and one of  $R^3$  and  $R^4$  is methyl and the other is hydrogen or both  $R^3$  and  $R^4$  are methyl.

4. A benzylidene- $\gamma$ -butyrolactone selected from the group consisting of p-methoxybenzylidene-4-methyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-4-butyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-4,4-dimethyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-3,4-dimethyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-3,4,4-trimethyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-3-methyl-4-pentyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-3-methyl-4-hexyl- $\gamma$ -butyrolactone, o,p-dimethoxybenzylidene-4-butyl- $\gamma$ -butyrolactone, o,p-dimethoxybenzylidene-4,4-dimethyl- $\gamma$ -butyrolactone, o,p-dimethoxybenzylidene-3,4-dimethyl- $\gamma$ -butyrolactone, m,p-dimethoxybenzylidene-4-butyl- $\gamma$ -butyrolactone, m,p-dimethoxybenzylidene-4,4-dimethyl- $\gamma$ -butyrolactone, m,p-dimethoxybenzylidene-3,4-dimethyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-3-ethyl-4,4-dimethyl- $\gamma$ -butyrolactone, p-methoxybenzylidene-3,4-dimethyl-4-butyl- $\gamma$ -butyrolactone, and p-methoxybenzylidene-3,4-dimethyl-4-ethyl- $\gamma$ -butyrolactone.
5. p-Methoxybenzylidene-3,4-dimethyl-4-ethyl- $\gamma$ -butyrolactone.
6. p-Methoxybenzylidene-3,4,4-trimethyl- $\gamma$ -butyrolactone.
7. p-Methoxybenzylidene-3-ethyl-4,4-dimethyl- $\gamma$ -butyrolactone.
8. p-Methoxybenzylidene-3,4-dimethyl-4-butyl- $\gamma$ -butyrolactone.
9. A cosmetic composition comprising:

27107-14

26

(A) the benzylidene- $\gamma$ -butyrolactone as defined in any one of claims 1 to 8, as a UV absorber, and

(B) a cosmetic base.

10. The cosmetic composition according to claim 9, which  
5 is an emulsion, a milk, a lotion, a cream, a gel, an aerosol, a shampoo, a conditioner, an intensive conditioner or a spray.

11. A pharmaceutical composition, comprising:

(A) a UV absorber effective amount of the  
benzylidene- $\gamma$ -butyrolactone as defined in any one of claims 1  
10 to 8, and

(B) an additive suitable for the pharmaceutical composition.

12. The composition according to any one of claims 9  
to 11, wherein the benzylidene- $\gamma$ -butyrolactone is contained in  
15 an amount of from 0.1 to 15% by weight based on the total weight of the composition.

13. The composition according to claim 12, wherein the amount is from 1 to 10% by weight.

14. The composition according to claim 12, wherein the  
20 amount is from 2 to 7% by weight.

15. The composition according to any one of claims 9  
to 14, which further comprises a UV absorber that is other than the benzylidene- $\gamma$ -butyrolactone defined in any one of claims 1  
to 8 and is selected from the group consisting of camphor  
25 derivatives, salicylic acid derivatives, benzimidazoles, benzotriazoles, benzophenones, triazines, cinnamic esters and oxalanilides.

27107-14

27

16. An industrial product selected from the group consisting of paints, surface coatings, plastics, textiles, packaging materials and rubbers, which further comprises the benzylidene- $\gamma$ -butyrolactone as defined in any one of claims 1 to 8 as a UV absorber for protecting the industrial product from harmful UV radiation.

17. A sunscreen or daycare product for protecting human skin or hair against harmful UV radiation, comprising:

(A) the benzylidene- $\gamma$ -butyrolactone as defined in any one of claims 1 to 8, and

(B) an additive suitable for the sunscreen or daycare product.

18. A method of enhancing solubility of a UV absorber into a cosmetic composition, wherein the UV absorber is other than the benzylidene- $\gamma$ -butyrolactone defined in any one of claims 1 to 8 and is selected from the group consisting of camphor derivatives, salicylic acid derivatives, benzimidazoles, benzotriazoles, benzophenones, triazines, cinnamic esters and oxalanilides, which method comprises:

mixing the benzylidene- $\gamma$ -butyrolactone as defined in any one of claims 1 to 8 and the UV absorber, with a cosmetic base.

FETHERSTONHAUGH &amp; CO.

OTTAWA, CANADA

PATENT AGENTS