

## Appendix 1

# Chemical UVR Absorbers

The names given in bold and used throughout this handbook are those of the International Nomenclature of Cosmetic Ingredients.

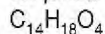
### ORGANIC CHEMICAL ABSORBERS

#### UVB absorbers

#### **Cinnamates**

##### **Cinoxate**

*Empirical formula:*



*Chemical names:*

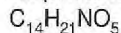
2-Ethoxyethyl-*para*-methoxycinnamate; 2-propenoic acid, 3-(4-methoxyphenyl)-2-ethoxyethyl ester; 2-ethoxyethyl-4-methoxycinnamate

*Trade names:*

Giv Tan F; Phiasol

##### **DEA-methoxycinnamate**

*Empirical formula:*



*Chemical names:*

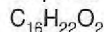
Diethanolamine salt of *para*-methoxyhydroxycinnamate; 2-propenoic acid, 3-(4-methoxyphenyl)-, compd with 2,2'-iminobis(ethanol)

*Trade name:*

Nipasorb D

##### **Diisopropyl methyl cinnamate**

*Empirical formula:*

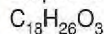


*Chemical names:*

2-Propenoic acid, 3-[2,4-bis(1-methylethyl)phenyl]-methyl ester; 2,5-diisopropyl methyl cinnamate

##### **Ethylhexyl methoxycinnamate**

*Empirical formula:*



*Chemical names:*

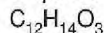
2-Ethylhexyl-4-methoxycinnamate; 2-ethyl-hexyl-*para*-methoxycinnamate; *para*-methoxycinnamic acid, 2-ethylhexyl ester; 3-(4-methoxyphenyl)-2-propenoic acid, 2-ethylhexyl ester; octinoxate; octyl methoxycinnamate; 2-propenoic acid, 3-(4-methoxyphenyl)-2-ethylhexyl ester

*Trade names:*

AEC Octyl Methoxycinnamate; Escalol 557; Eusolex 2292; Heliosol 3; Jeecscreen OMC; Katoscreen OMC; Neo Heliopan, Type AV; Parsol MCX; Solarum OMC; Uvinul MC 80

##### **Ethyl methoxycinnamate**

*Empirical formula:*



*Chemical names:*

*para*-Methoxycinnamic acid, ethyl ester; 3-(4-methoxyphenyl)-2-propenoic acid, ethyl ester

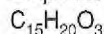
##### **Glyceryl ethylhexanoate dimethoxycinnamate**

*Chemical names:*

Glyceryl octanoate dimethoxycinnamate; 2-propenoic acid, 3-(4-methoxyphenyl)-, diester with 1,3-dihydroxy-2-(2-ethyl-1-oxohexyl)oxypropane

##### **Isoamyl-*para*-methoxycinnamate**

*Empirical formula:*



*Chemical names:*

Amyl-4-methoxycinnamate; isopentyl-4-methoxycinnamate; isopentyl-*para*-methoxy-cinnamate; 3-(4-methoxyphenyl)-2-propenoic acid, isopentyl ester

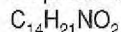
*Trade names:*

Neo Heliopan type E 1000; Solarum AMC

#### ***para*-Aminobenzoic acids (PABAs)**

##### **Amyl dimethyl PABA**

*Empirical formula:*



*Chemical names:*

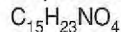
Amyl *para*-*N,N*-dimethylaminobenzoate

*Trade names:*

Escalol 506; Padimate A

##### **Ethyl dihydroxypropyl PABA**

*Empirical formula:*



*Chemical names:*

Benzoic acid, 4-[bis(2-hydroxypropyl)-amino]ethyl ester (mixed isomers); ethyl-4-bis(2-hydroxypropyl)aminobenzoate, mixed isomers; ethyl dihydroxypropyl *para*-aminobenzoate, mixed isomers; *N*-propoxylated-ethyl-4-aminobenzoate (mixed isomers)

*Trade name:*

Amerscreen P

**Ethylhexyl dimethyl PABA***Empirical formula:*

$C_{17}H_{27}NO_2$

*Chemical names:*

Benzoic acid, 4-(dimethylamino)-, 2-ethylhexyl ester; benzoic acid, 4-(dimethylamino)-, octyl ester; 4-(dimethylamino)benzoic acid, 2-ethylhexyl ester; 2-ethylhexyl-4-(dimethylamino)benzoate; 2-ethylhexyl *para*-dimethylamino benzoate; octyldimethyl PABA; octyl dimethyl *para*-aminobenzoate

*Trade names:*

Arlatone UVB; Escalol 507; Eusolex 6007; Katoscreen ODMF; Padimate O; Sunarome PLUS; Uvasorb DMO

**Ethyl PABA***Empirical formula:*

$C_9H_{11}NO_2$

*Chemical names:*

Anesthesin; ethyl *para*-aminobenzoate

**Glyceryl PABA***Empirical formula:*

$C_{10}H_{13}NO_4$

*Chemical names:*

1-(4-Aminobenzoate)-1,2,3-propanetriol; 4-aminobenzoic acid glyceryl ester; glyceryl-*para*-aminobenzoate; glycerol 1-(4-aminobenzoate); PABA monoglyceride; propanetriol 1-(4-aminobenzoate)

*Trade name:*

Escalol 106

**PABA***Empirical formula:*

$C_7H_7NO_2$

*Chemical names:*

Acid (PABA); aminobenzoic acid; 4-aminobenzoic acid; *para*-aminobenzoic acid; aniline-4-carboxylic acid; benzoic acid, 4-amino-; *para*-carboxyaniline; *para*-carboxyphenylamine

*Trade names:*

Amben; Pabacidum; Pabanol

**PEG-25 PABA***Empirical formula:*

$C_{59}H_{111}NO_{27}$

*Chemical names:*

4-Bis(polyethoxy)-4-aminobenzoic acid polyethoxyethyl ester; ethoxylated ethyl-*para*-aminobenzoic acid; ethoxylated ethyl-4-aminobenzoate

*Trade names:*

Lusantan 25; Uvinul P-25

**Salicylates****Dipropylene glycol salicylate***Empirical formula:*

$C_{13}H_{18}O_4$

*Chemical names:*

2-Hydroxybenzoic acid dipropylene glycol ester; 2-(2-hydroxypropyl)-1-methyl-ethyl salicylate

**Ethylene glycol salicylate***Empirical formula:*

$C_9H_{10}O_5$

*Chemical names:*

2-Hydroxybenzoic acid ethylene glycol ester; 1,2-ethanediol salicylate

**Ethylhexyl salicylate***Empirical formula:*

$C_{15}H_{22}O_3$

*Chemical names:*

Benzoic acid, 2-hydroxy-2-ethylhexyl ester; 2-ethylhexyl 2-hydroxybenzoate; 2-ethylhexyl salicylate; salicylic acid, 2-ethylhexyl ester; octisalate; octyl salicylate

*Trade names:*

Dermoblock (OS); Escalol 587; Eusolex OS; Hallbrite OS; Heliosol 2; Katoscreen OS; Neo Heliopan, Type OS; Neotan L; Solarum OS; Sonnelan UV; Sunarome WMO; Trivent OS; Uvinul O-18

**Homosalate***Empirical formula:*

$C_{16}H_{22}O_3$

*Chemical names:*

Benzoic acid, 2-hydroxy- 3,3,5-trimethylcyclohexyl ester; cyclohexanol, 3,3,5-trimethyl salicylate; homomenthyl salicylate; metahomenthyl salicylate; 3,3,5-trimethylcyclohexyl 2-hydroxybenzoate; 3,3,5-trimethyl cyclohexyl salicylate

*Trade names:*

Eusolex HMS; Filtrosol A; Heliopan; Uniderm HOMSAL

**Isopropylbenzyl salicylate***Empirical formula:*

$C_{16}H_{16}O_3$

*Chemical names:*

4-Isopropylbenzyl salicylate; 2-hydroxybenzoic acid 4-isopropylbenzyl ester

*Trade name:*

Megasol

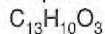
**Methyl salicylate***Empirical formula:*

$C_8H_8O_3$

*Chemical names:*

Benzoic acid, 2-hydroxy-, methyl ester; betula oil; *ortho*-hydroxybenzoic acid, methyl ester; 2-(methoxycarbonyl)phenol; methyl *ortho*-hydroxybenzoate; methyl 2-hydroxybenzoate; oil of wintergreen; salicylic acid, methyl ester; teaberry oil

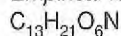


**Phenyl salicylate***Empirical formula:**Chemical name:*

2-Hydroxybenzoic acid phenyl ester

*Trade names:*

Salol; UVSAM-2142

**TEA salicylate***Empirical formula:**Chemical names:*

Benzoic acid, 2-hydroxy-, compd with 2,2',2''-nitrolotris[ethanol] (1:1); 2-hydroxybenzoic acid, compd with 2,2',2''-nitrolotris[ethanol] (1:1); triethanolamine salicylate; troloamine salicylate

*Trade names:*

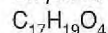
Katoscreen TES; Neo Heliopan, Type TS; Neotan W; Sunarome G; Sunarome W

**Camphor derivatives****3-Benzylidene camphor***Empirical formula:**Chemical names:*

3-Benzylidenebornan-2-one; 1,7,7-trimethyl-3-(phenylmethylene)bicyclo-[2.2.1]heptan-2-one

*Trade names:*

Mexoryl SD; Ultracyd; Ultren BK

**Benzylidene camphor sulfonic acid***Empirical formula:**Chemical names:* $\alpha$ -(2-Oxoborn-3-ylidene)-toluene-4-sulfonic acid; 3-(4'-sulfobenzylidene) camphor*Trade name:*

Mexoryl SL

**Camphor benzalkonium methosulfate***Chemical names:*Methyl-*N,N,N*-trimethyl-4-[(4,7,7-trimethyl-3-oxobicyclo[2.2.1]hept-2-ylidene)methyl]anilinium sulfate; 3-(4'-trimethylammonium benzylidene)-1-bornan-2-one methyl sulfate; *N,N,N*-tri-methyl-4-(2-oxoborn-3-ylidene methyl)-anilinium methyl sulfate*Trade name:*

Mexoryl SO

**4-Methylbenzylidene camphor***Empirical formula:**Chemical names:*3-(4-Methylbenzylidene)bornan-2-one; 3-(4'-methylbenzylidene)-1 camphor; 1,7,7-trimethyl-3-(*para*-methylphenylmethylene)-bicyclo[2.2.1]-heptane-2-one*Trade names:*

Eusolex 6300; Neo Heliopan, Type MBC; Parsol 5000; Solarum MBC; Uvinul MBC 95

**Polyacrylamidomethyl benzylidene camphor***Chemical name:*Polymer of *N*-(2 and 4)-[(2-oxoborn-3-ylidene)methyl]-benzyl]-acrylamide*Trade name:*

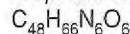
Mexoryl SW

**Miscellaneous****Diethylhexylbutamido triazone***Chemical names:*

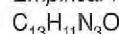
Benzoic acid, 4,4'-[(-6-[[1,1-dimethylethyl)-aminocarbonyl]-phenylamino)-1,3,5-triazine-2,4-diyl]-diimino]bis-, bis (2-ethylhexyl) ether; dioctylbutamido triazone

*Trade name:*

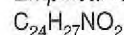
Uvasorb HEB

**Ethylhexyl triazone***Empirical formula:**Chemical names:*Octyl triazone; 2,4,6-trianilino-(*para*-carbo-2'-ethylhexyl-1'-oxy)-1,3,5 triazine*Trade name:*

Uvinul T-150

**5-Methyl-2-phenylbenzoxazole***Empirical formula:**Chemical names:*2-(2*H*-Benzotriol-2-yl)-*para*-cresol; 2-(2'-hydroxy-5'-methylphenyl)benzotriazole*Trade name:*

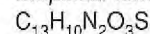
Tinuvin P

**Octocrylene***Empirical formula:**Chemical names:*

2-Cyano-3,3-diphenyl acrylic acid, 2-ethylhexyl ester; 2-ethylhexyl 2-cyano-3,3-diphenylacrylate; 2-ethylhexyl 2-cyano-3,3-diphenyl-2-propenoate; 2-ethylhexyl 2-cyano-3-phenylcinnamate; 2-propenoic acid, 2-cyano-3,3-diphenyl-, 2-ethylhexyl ether

*Trade names:*

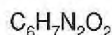
Escalol 597; Eusolex OCR; Neo Heliopan, Type 303; Parsol 340; Solarum OCR; UV Absorber 3; Uvinul N-539T

**Phenylbenzimidazole sulfonic acid***Empirical formula:**Chemical names:*

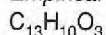
2-Phenylbenzimidazol-5-sulfonic acid; 2-phenyl-5-sulfobenzimidazole

*Trade names:*

Ensulizole; Eusolex 232; Neo Heliopan, Type Hydro; Novantisol; Parsol HS

**Urocanic acid***Empirical formula:**Chemical name:*

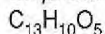
3-(Imidazol-4-yl)acrylic acid

**UVA absorbers****Benzophenones****Benzophenone-1***Empirical formula:**Chemical names:*

Benzoresorcinol; 2,4-dihydroxybenzophenone

*Trade names:*

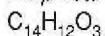
ASL-23; Syntase 100; Uvasorb 20H/G; Uvinul 400; UVSAM-214

**Benzophenone-2***Empirical formula:**Chemical names:*

Bis(2,4-dihydroxyphenyl) methanone; 2,2',4,4'-tetrahydroxybenzophenone

*Trade name:*

Uvinul D-50

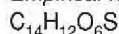
**Benzophenone-3***Empirical formula:**Chemical names:*

2-Benzyl-5-methoxyphenol; 2-hydroxy-4-methoxybenzophenone; (2-hydroxy-4-methoxyphenyl)phenylmethanone; methanone (2-hydroxy-4-methoxyphenyl)phenyl; oxybenzone

*Trade names:*

ASL 24; Cyasorb UV-9; Escalol 567; Eusolex 4360; EUSORB 228; Jeescreeen

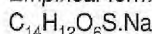
Benzophenone 3; Katoscreen B-3; Marsorb 24; Neo Heliopan, Type BB; Protaphenone-3; Solarum B ZP3; Spectra-Sorb UV-9; Syntase 62; Uvasorb MeT/C; Uvinul M-40; Uvistat 24

**Benzophenone-4***Empirical formula:**Chemical names:*

Benzenesulfonic acid, 5-benzoyl-4-hydroxy-2-methoxy-; 5-benzoyl-hydroxy-2-methoxybenzene-sulfonic acid; 5-benzoyl-4-hydroxy-2-methoxybenzene sulfonic acid; 2-hydroxy-4-methoxybenzophenone-5-sulfonic acid; 1-phenol-4-sulfonic acid, 2-benzoyl-5-methoxy-; sulisobenzone

*Trade names:*

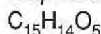
Aduvex 112; Escalol 577; Jeescreeen Benzophenone 4; Protaphenone-4; Syntase 230; Uval; Uvasorb S5; Uvinul MS-40; Uvistat 112

**Benzophenone-5***Empirical formula:**Chemical names:*

Benzenesulfonic acid, 5-benzoyl-4-hydroxy-2-methoxy-, monosodium salt; sodium 2-hydroxy-4-methoxy-5-sulfobenzophenone; benzophenone-4 sodium salt

*Trade name:*

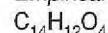
ASL-24S

**Benzophenone-6***Empirical formula:**Chemical names:*

Bis(2-hydroxy-4-methoxyphenyl) methanone; 2,2'-dihydroxy-4,4'-dimethoxybenzophenone

*Trade name:*

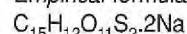
Uvinul D-49

**Benzophenone-8***Empirical formula:**Chemical names:*

2,2'-Dihydroxy-4-methoxybenzophenone; dioxybenzone; (2-hydroxy-4-methoxyphenyl)(2-hydroxyphenyl)-methanone; methanone, (2-hydroxy-4-methoxyphenyl)(2-hydroxyphenyl)-

*Trade name:*

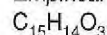
Spectra-Sorb UV-24

**Benzophenone-9***Empirical formula:**Chemical names:*

Disodium-3,3'-carbonylbis[4-hydroxy-6-methoxybenzenesulfonate]; sodium 2,2'-dihydroxy-4,4'-dimethoxy-5-sulfobenzophenone

*Trade name:*

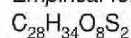
Uvinul DS-49

**Benzophenone-10***Empirical formula:**Chemical names:*

2-Hydroxy-4-methoxy-4'-methylbenzophenone; (2-hydroxy-4-methoxyphenyl)-(4-methylphenyl)-methanone

*Trade names:*

Aduvex 2211; Mexenone; Uvistat 2211

**Camphor derivatives****Terephthalylidene dicamphor sulfonic acid***Empirical formula:**Chemical names:*

3,3'-(1,4-Phenylenedimethylene)bis(7,7-dimethyl-2-oxo-bicyclo[2.2.1]hept-1-yl-methanesulfonic) acid



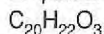
*Trade names:*

Ecamsule; Mexoryl SX

### **Dibenzoylmethanes**

#### **Butyl methoxydibenzoylmethane**

*Empirical formula:*



*Chemical names:*

Avobenzone; 4-*tert*-butyl-4'-methoxydibenzoylmethane; 1-(4-*tert*-butylphenyl)-3-(4-methoxyphenyl)propane-1,3-dione; 1-[4-(1,1-dimethylethyl)phenyl]-3-(4-methoxyphenyl)-1,3-propanedione; 1,3-propanedione, 2-butyl-2-methoxy-1,3-diphenyl-; 1,3-propanedione, 1-[4-(1,1-dimethylethyl)phenyl]-3-(4-methoxyphenyl)

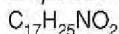
*Trade names:*

Eusolex 9020; Neo Heliopan, Type MA; Parsol 1789; Parsol A; Solarum BMBM; Solarum MA

### **Anthranilates**

#### **Menthyl anthranilate**

*Empirical formula:*



*Chemical names:*

Cyclohexanol, 5-methyl-2-(1-methylethyl)-2-aminobenzoate; menthyl-*ortho*-aminobenzoate; meradimate

*Trade names:*

Neo Heliopan MA; Trivent MA

### **Miscellaneous**

#### **Bisimidazolylate**

*Chemical name:*

2,2'-Bis(1,4-phenylene)-1*H*-benzimidazole-4,6-disulfonic acid, monosodium salt

## **UVA and UVB absorbers**

### **Miscellaneous**

#### **Anisotriazine**

*Chemical name:*

2,4-Bis[4-(2-ethylhexyloxy)-2-hydroxy]phenyl-6-(4-methoxyphenyl)-tetramethylbutyl-phenol (1,3,5)-triazine

#### **Drometrizole trisiloxane**

*Chemical name:*

Phenol, 2-(2*H*-benzotriazol-2-yl)-4-methyl-6-{2-methyl-3-[1,3,3,3-tetramethyl-1-(trimethylsilyloxy)disiloxanyl]propyl

*Trade name:*

Mexoryl XL

#### **Methylene bisbenzotriazolyl tetramethylbutylphenol**

*Chemical names:*

2,2'-Methylene-bis-6-(2*H*-benzotriazol-2-yl)-4-(1,1,3,3-tetramethylbutyl)phenol

## **INORGANIC CHEMICAL ABSORBERS**

#### **Titanium dioxide**

*Empirical formula:*



*Chemical names:*

Amorphous titanium dioxide; micro particle titanium dioxide; pigment white 6; titanium dioxide sol; titanium oxide

*Trade names:*

A310 Tudor Aspen; Atlas White Titanium Dioxide 09985; C47-5175 Cosmetic White; CI 77891; Kowet Titanium Dioxide 09970; Kronos 1025; KRONOS 2071-U;

Micro T; Micro Titanium Dioxide MT-500B; Micro Titanium Dioxide MT-150W; MTD-25; NanoGard AQ; Nano TZ; Oxyde de Titane Organophile W 877; Oxyde de Titane Standard; P25; Sicovit White E 171; SI-UF20-Z; SI-UFTR-Z; Spherititan; TiO<sub>2</sub> C9228 Blend; TiO<sub>2</sub> D13; Ti-Sphere AA-1515; Ti-Sphere AA-1512-LL; Titanium Dioxide P 25; Titanium Dioxide 10-34-PC-0082; Titanium Dioxide 10-34-PC-0748; Titanium Dioxide, USP, CTFA, Bacteria Controlled; UF-20; UFTR; Uniwhite AO; Uniwhite KO; UV-Titan

#### **Zinc oxide**

*Empirical formula:*



*Chemical names:*

Low temperature burned zinc oxide; pigment white 4; zinc white

*Trade names:*

CI 77947; Finex-25; MZO-25; NanoGard Zinc Oxide; Nano-TZ; Nanox; Nano-Zinc SL; Oxyde de Zinc Micropure; Unichem ZO; USP 1; USP-2; Z-Cote; Zinc Oxide Neutral H&R (PN 104 702); Zinc Oxide USP 66

## Appendix 2

# Definition of genetic test codes

End-point <sup>a</sup>	Code	Definition
<b>Non-mammalian systems</b>		
<i>Prokaryotic systems</i>		
G	SA0	<i>Salmonella typhimurium</i> TA100, reverse mutation
G	SA2	<i>Salmonella typhimurium</i> TA102, reverse mutation
G	SA5	<i>Salmonella typhimurium</i> TA1535, reverse mutation
G	SA7	<i>Salmonella typhimurium</i> TA1537, reverse mutation
G	SA8	<i>Salmonella typhimurium</i> TA1538, reverse mutation
G	SA9	<i>Salmonella typhimurium</i> TA98, reverse mutation
G	ECW	<i>Escherichia coli</i> WP2 <i>uvrA</i> , reverse mutation
G	EC2	<i>Escherichia coli</i> WP2, reverse mutation
 <i>Lower eukaryotic systems</i>		
D	SSD	<i>Saccharomyces</i> species, DNA repair-deficient strains, differential toxicity
R	SCG	<i>Saccharomyces cerevisiae</i> , gene conversion
G	SCR	<i>Saccharomyces cerevisiae</i> , reverse mutation
 <i>Insect systems</i>		
G	DMM	<i>Drosophila melanogaster</i> , somatic mutation
G	DMX	<i>Drosophila melanogaster</i> , sex-linked recessive lethal mutations
 <b>Mammalian systems</b>		
<i>Animal cells in vitro</i>		
G	G5T	Gene mutation, mouse lymphoma L5178Y cells, <i>Tk</i> locus
G	G51	Gene mutation, mouse lymphoma L5178Y cells, all other loci
S	SIC	Sister chromatid exchange, Chinese hamster cells <i>in vitro</i>
C	CIC	Chromosomal aberrations, Chinese hamster cells <i>in vitro</i>
 <i>Human cells in vitro</i>		
D	DIH	DNA strand breaks, cross-links or related damage, human cells <i>in vitro</i>
 <i>Animals in vivo</i>		
M	MVR	Micronucleus formation, rats <i>in vivo</i>
C	CBA	Chromosomal aberrations, animal bone-marrow cells <i>in vivo</i>

<sup>a</sup> End-points are grouped within each phylogenetic category as follows: C, chromosomal aberrations; D, DNA damage; G, gene mutation; M, micronuclei; R, mitotic recombination or gene conversion; S, sister chromatid exchange