

Tanning aids

The present invention relates to tanning aids which comprise a polymethyl methacrylate shaped body.

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A slightly tanned skin is a sign of holiday and health. In order to tan the skin, sunscreen creams and the like are usually used as tanning aids in order to protect the skin against damage by UV radiation. A disadvantage of these auxiliaries is that such creams can trigger allergies in sensitive people. Furthermore, many of these substances are not water-resistant. Accordingly, they are removed during bathing, and are then not applied again. This negligence can easily lead to skin damage.

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Moreover, devices are known which bring about tanning of the skin with the help of incorporated UV emitters. Also known in this connection are lying devices for solarium applications made of PMMA, which comprise large amounts of UV stabilizers and/or UV absorbers in order to protect the plastic against degradation by UV radiation. Tanning with sunlight is not possible here, however. A disadvantage of such devices is the high energy consumption of the UV emitters. Moreover, these installations are not intended for operation outdoors, meaning that tanning is more likely to be perceived as boring.

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In view of the prior art given and discussed here, it was consequently an object of the present invention to provide tanning aids which can be used to achieve natural tanning of the skin using sunlight without the skin coming into contact with sunscreen cream.

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Moreover, it was an object of the present invention to provide a tanning aid which is particularly easy to maintain.

A further object of the invention was that the tanning aids have high durability, in particular high resistance to UV irradiation or weathering.

5 Furthermore, the object underlying the invention was to provide tanning aids which can be produced in a particularly simple manner. Thus, for the production of the tanning aids, it should be possible, in particular, to use substrates which are obtainable by extrusion,
10 injection molding, and by casting processes.

A further object of the present invention was to provide tanning aids whose sun protection can be adjusted in a particularly simple manner. For example,
15 it should be possible to adjust the time spent under the tanning aid to a pregiven time for many skin types. With regard to classical sunscreen cream, it should be possible to adjust these tanning aids accordingly to a certain sun protection factor.

20 Moreover, it should be possible to adapt the tanning aids of the present invention in a particularly simple manner to different requirements and applications. Thus, for example, portable screens and built-in roofs
25 should be available. In this connection, it should be possible to adapt the tanning aids to the requirements in a simple manner with respect to size and shape.

These objects and others which, while not specified in
30 terms of words, can be derived quite naturally from the connections discussed herein or arise automatically from these, are achieved by the tanning aids described in claim 1.

35 Advantageous modifications of the tanning aids according to the invention are protected in the dependent claims which relate back to claim 1.

With regard to the use, claim 16 provides a solution to the underlying object.

As a result of the fact that the tanning aid comprises
5 a polymethyl methacrylate shaped body which comprises
0.1 to 1.5% by weight of a UV stabilizer containing
2,2,6,6-tetraalkylpiperidyl groups and which, dissolved
in MMA at a concentration of 1% by weight, exhibits a
transmission of at least 95% at 330 nm and the
10 polymethyl methacrylate shaped body comprises 0.005 to
0.1% by weight of a UV absorber which, dissolved in MMA
at a concentration of 0.02% by weight, exhibits a
transmission of at most 5% at 320 nm and a transmission
of at least 80% at 370 nm, where the transparency of
15 the polymethyl methacrylate shaped body at 380 nm is at
least 40%, it is surprisingly possible to provide a
tanning aid with the help of which natural tanning with
sunlight is possible without the skin coming into
contact with sunscreen cream.

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The measures according to the invention achieve, inter alia, in particular the following advantages:

- 25 ➤ The tanning aids according to the invention make tanning outside possible.
- Furthermore, it is possible to dispense with energy-intensive UV emitters during tanning.
- 30 ➤ The tanning aids according to the invention are easy to maintain and easy to produce. Thus, it is possible, in particular, to use shaped bodies which are obtainable by extrusion, injection molding and casting processes.
- 35 ➤ The tanning aids are weathering-resistant and, in particular, resistant to UV radiation. Furthermore, the tanning aids according to the invention have very good mechanical properties.

- Furthermore, the tanning aids according to the invention can be adapted easily to very diverse requirements. Thus, it is possible to produce, in particular, transportable screens or solid roofs in any size in order to permit natural tanning of the skin without having to worry about skin damage as a result.
- 10 ➤ Moreover, the tanning aids can be produced for each skin type, meaning that different durations outside can be provided.

For the purposes of the present invention, the term tanning aid means a device which comprises at least one polymethyl methacrylate shaped body which can be brought between the sunlight and a skin surface to be tanned. Accordingly, these may, in particular, be transparent roofs of buildings or screens which are, for example, immovably fixed. Moreover, roofs which can be fixed to boats, in particular paddle boats, electric boats and the like, are suitable as tanning aids.

Moreover, however, they may also be transportable screens which, depending on the thickness of the polymethyl methacrylate shaped body, are fixed in terms of their dimensions, or which can also be folded up.

The tanning aid according to the invention comprises a polymethyl methacrylate shaped body. Polymethyl methacrylate (PMMA) is known per se in the specialist field. The polymethyl methacrylate shaped body preferably comprises at least 30% by weight, based on the weight of the polymethyl methacrylate shaped body, of polymethyl methacrylate.

Polymethyl methacrylates are generally obtained by free-radical polymerization of mixtures which comprise methyl methacrylate. In general, these mixtures

comprise at least 40% by weight, preferably at least 60% by weight and particularly preferably at least 80% by weight, based on the weight of the monomers, of methyl methacrylate.

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In addition, these mixtures for the preparation of polymethyl methacrylates can comprise further (meth)acrylates which are copolymerizable with methyl methacrylate. The expression (meth)acrylates includes
10 methacrylates and acrylates, and mixtures of the two.

These monomers are also known. These include, inter alia, (meth)acrylates, which are derived from saturated alcohols, such as, for example, methyl acrylate, ethyl
15 (meth)acrylate, propyl (meth)acrylate, n-butyl (meth)acrylate, tert-butyl (meth)acrylate, pentyl (meth)acrylate and 2-ethylhexyl (meth)acrylate;

(meth)acrylates which are derived from unsaturated alcohols, such as, for example, oleyl (meth)acrylate,
20 2-propynyl (meth)acrylate, allyl (meth)acrylate, vinyl (meth)acrylate;

aryl (meth)acrylates, such as benzyl (meth)acrylate or phenyl (meth)acrylate, where the aryl radicals may in each case be unsubstituted or substituted up to four
25 times;

cycloalkyl (meth)acrylates, such as 3-vinylcyclohexyl (meth)acrylate, bornyl (meth)acrylate;

hydroxyalkyl (meth)acrylates, such as 3-hydroxypropyl (meth)acrylate, 3,4-dihydroxybutyl (meth)acrylate,
30 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate;

glycol di(meth)acrylates, such as 1,4-butanediol (meth)acrylate, (meth)acrylates of ether alcohols, such as tetrahydrofurfuryl (meth)acrylate, vinyloxyethoxy-
35 ethyl (meth)acrylate;

amides and nitriles of (meth)acrylic acid, such as N-(3-dimethylaminopropyl) (meth)acrylamide, N-(diethylphosphono) (meth)acrylamide, 1-methacryloylamido-2-methyl-2-propanol;

sulfur-containing methacrylates, such as ethyl-
sulfinylethyl (meth)acrylate,
4-thiocyanatobutyl (meth)acrylate,
ethylsulfonylethyl (meth)acrylate,
5 thiocyanatomethyl (meth)acrylate,
methylsulfinylmethyl (meth)acrylate,
bis((meth)acryloyloxyethyl) sulfide;
polyvalent (meth)acrylates, such as
trimethyloylpropane tri(meth)acrylate.

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As well as the (meth)acrylates listed above, the
compositions to be polymerized can also have further
unsaturated monomers which are copolymerizable with
methyl methacrylate and the abovementioned
15 (meth)acrylates.

These include, inter alia, 1-alkenes, such as 1-hexene,
1-heptene; branched alkenes, such as, for example,
vinylcyclohexane, 3,3-dimethyl-1-propene, 3-methyl-1-
20 diisobutylene, 4-methyl-1-pentene;

acrylonitrile; vinyl esters, such as vinyl acetate;
styrene, substituted styrenes with an alkyl substituent
in the side chain, such as, for example, α -methyl-
25 styrene and α -ethylstyrene, substituted styrenes with
an alkyl substituent on the ring, such as vinyltoluene
and p-methylstyrene, halogenated styrenes, such as, for
example, monochlorostyrenes, dichlorostyrenes, tri-
bromostyrenes and tetrabromostyrenes;
30 heterocyclic vinyl compounds, such as 2-vinylpyridine,
3-vinylpyridine, 2-methyl-5-vinylpyridine, 3-ethyl-4-
vinylpyridine, 2,3-dimethyl-5-vinylpyridine, vinyl-
pyridimidine, vinylpiperidine, 9-vinylcarbazole, 3-
vinylcarbazole, 4-vinylcarbazole, 1-vinylimidazole,
35 2-methyl-1-vinylimidazole, N-vinylpyrrolidone, 2-vinyl-
pyrrolidone, N-vinylpyrrolidine, 3-vinylpyrrolidine,
N-vinylcaprolactam, N-vinylbutyrolactam, vinyloxolane,
vinylfuran, vinylthiophene, vinylthiolan, vinyl-

thiazoles and hydrogenated vinylthiazoles, vinyl-oxazoles and hydrogenated vinyloxazoles;

vinyl and isoprenyl ethers;

- 5 maleic acid derivatives, such as, for example, maleic anhydride, methylmaleic anhydride, maleinimide, methylmaleinimide; and dienes, such as, for example, divinylbenzene.

- 10 In general, these comonomers are used in an amount of from 0 to 60% by weight, preferably 0 to 40% by weight and particularly preferably 0 to 20% by weight, based on the weight of the monomers, where the compounds can be used individually or as a mixture.

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- The polymerization is generally started using known free-radical initiators. Preferred initiators include, inter alia, the azo initiators known throughout the specialist field, such as AIBN and 1,1-
20 azobiscyclohexanecarbonitrile, and peroxy compounds, such as methyl ethyl ketone peroxide, acetylacetone peroxide, dilauryl peroxide, tert-butyl per-2-ethylhexanoate, ketone peroxide, methyl isobutyl ketone peroxide, cyclohexanone peroxide, dibenzoyl peroxide,
25 tert-butyl peroxybenzoate, tert-butyl peroxyisopropylcarbonate, 2,5-bis(2-ethylhexanoylperoxy)-2,5-dimethylhexane, tert-butyl peroxy-2-ethylhexanoate, tert-butyl peroxy-3,5,5-trimethylhexanoate, dicumyl peroxide, 1,1-bis(tert-butylperoxy)cyclohexane, 1,1-bis(tert-butylperoxy)-3,3,5-trimethylcyclohexane, cumyl hydro-
30 peroxide, tert-butyl hydroperoxide, bis(4-tert-butylcyclohexyl)peroxydicarbonate, mixtures of two or more of the specified compounds with one another, and mixtures of the specified compounds with unspecified
35 compounds which can likewise form free radicals.

These compounds are often used in an amount of from 0.01 to 10% by weight, preferably from 0.5 to 3% by weight, based on the weight of the monomers.

In this connection, it is possible to use different poly(meth)acrylates which differ, for example, in their molecular weight or in the monomer composition.

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Furthermore, the polymethyl methacrylate shaped body can comprise further polymers in order to modify the properties. These include, inter alia, polyacrylonitriles, polystyrenes, polyethers, polyesters, 10 polycarbonates and polyvinyl chlorides. These polymers can be used individually or as a mixture, where also copolymers which can be derived from the abovementioned polymers.

15 The plastic substrates according to the invention can, for example, be prepared from molding materials of the abovementioned polymers. In this connection, use is generally made of thermoplastic molding processes, such as extrusion or injection molding.

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The weight-average of the molecular weight M_w of the homopolymers and/or copolymers to be used according to the invention as molding material for the preparation of the plastic substrates can vary within wide ranges, 25 the molecular weight usually being matched to the intended use and the processing method of the molding material. However, it is generally in the range between 20 000 and 1 000 000 g/mol, preferably 50 000 to 500 000 g/mol and particularly preferably 80 000 to 30 300 000 g/mol, without being limited by this. This parameter can be determined, for example, by means of gel permeation chromatography.

35 Furthermore, the plastic substrates can be produced by casting chamber processes. In this, suitable (meth)acrylic mixtures are, for example, placed into a mold and polymerized. Such (meth)acrylic mixtures generally have the above-described (meth)acrylates, in particular methyl methacrylate. Furthermore, the

(meth)acrylic mixtures can comprise the above-described copolymers and, particularly for adjusting the viscosity, polymers, in particular, poly-(meth)acrylates.

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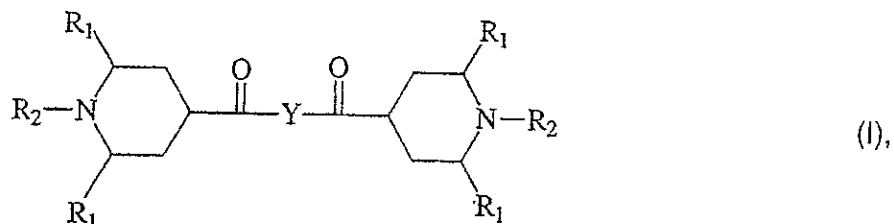
The weight-average of the molecular weight M_w of the polymers which are prepared by casting chamber processes is generally higher than the molecular weight of polymers which are used in molding materials. This gives rise to a number of known advantages. In general, the weight average of the molecular weight of polymers which are prepared by casting chamber processes is in the range from 500 000 to 10 000 000 g/mol, without being limited by this.

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According to a particular embodiment of the present invention, the matrix of the polymethyl methacrylate shaped body has at least 70%, preferably at least 80%, and particularly preferably at least 90% by weight, based on the weight of the polymethyl methacrylate shaped body, of polymethyl methacrylate.

The polymethyl methacrylate shaped body comprises 0.1 to 1.5% by weight, preferably from 0.3 to 0.7% by weight, based on the weight of the polymethyl methacrylate shaped body, of a UV stabilizer containing 2,2,6,6-tetraalkylpiperidyl groups and which, dissolved in methyl methacrylate at a concentration of 1% by weight, based on the total mixture, exhibits a transmission of at least 95% at 330 nm. Such UV stabilizers are known per se and are commercially available.

It is preferably a compound according to formula (I)



in which the radicals R_1 are an alkyl group having 1 to 6 carbon atoms, R_2 is a hydrogen atom or an alkyl group having 1 to 6 carbon atoms and Y is a linking alkylene group having 2 to 20 carbon atoms.

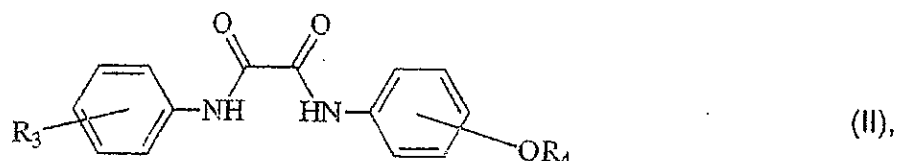
Preferred alkyl groups include the methyl, ethyl, propyl, isopropyl, 1-butyl, 2-butyl, 2-methylpropyl and tert-butyl group.

Preferred linking alkylene groups include ethylene, propylene, butylene, pentylene, hexylene, cyclohexylene, heptylene, 2-methylheptenylene, 3-methylheptylene, octylene, nonylene, 3-ethylnonylene, decylene, undecylene, 4-propenylnundecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene.

The UV stabilizer is particularly preferably bis(2,2,6,6-tetramethyl-4-piperidyl) sebacate. This compound is available commercially under the trade name TINUVIN 770 from Ciba Geigy, Mark LA 770 from Adeka Argus and Sanol LK 770 from.

Furthermore, the polymethyl methacrylate shaped body comprises 0.005 to 0.1% by weight, preferably 0.01 to 0.04% by weight, based on the total weight of the polymethyl methacrylate shaped body, at least one UV absorber which, dissolved in methyl methacrylate at a concentration of 0.02% by weight, based on the total weight of the mixture, exhibits a transmission of at most 5% at 320 nm and a transmission of at least 80% at 370 nm.

Preference is given to UV stabilizers according to formula (II)

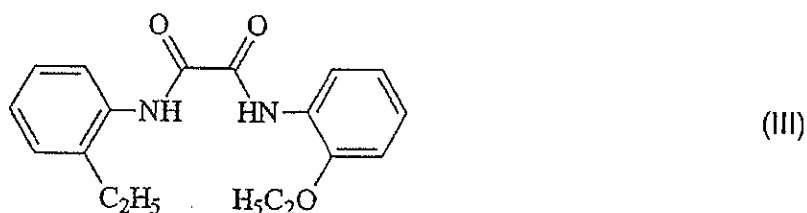


5 in which the radicals R_3 and R_4 , independently, are an alkyl or cycloalkyl radical having 1 to 20 carbon atoms. The aliphatic radicals may be linear or branched, it being possible for these radicals to have
10 substituents, such as, for example, halogen atoms.

Preferred alkyl groups include the methyl, ethyl, propyl, isopropyl, 1-butyl, 2-butyl, 2-methylpropyl, tert-butyl radical, pentyl, 2-methylbutyl, 1,1-
15 dimethylpropyl, hexyl, heptyl, octyl, 1,1,3,3-tetramethylbutyl, nonyl, 1-decyl, 2-decyl, undecyl, dodecyl, pentadecyl and the eicosyl group.

Preferred cycloalkyl groups include the cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl and
20 the cyclooctyl group, which are optionally substituted by branched or unbranched alkyl groups.

Particular preference is given to using the compound of
25 the formula (III)



as UV absorber.

This compound is commercially available from Clariant under the trade name ®Sanduvor VSU and from Ciba Geigy under the trade name ®Tinuvin 312.

5 Furthermore, the polymethyl methacrylate shaped body can comprise further known additives, their amount, however, being restricted to the intended use of the tanning aids according to the invention. These include, inter alia, antistatics, antioxidants, mold-release
10 agents, flame retardants, lubricants, dyes, flow improvers, fillers, light stabilizers, UV absorbers and organic phosphorus compounds, such as phosphites or phosphonates, pigments, anti-weathering agents and plasticizers.

15 Preferred additives include dyes which, dissolved in methyl methacrylate at a concentration of 0.01% by weight, display a transmission at 350 nm of at least 30%. Such dyes are known per se and are available, for
20 example, under the trade name ®Makrolex Blue RR, ®Makrolex Violet B, ®Makrolex Violet 3R, ®Makrolex Green 5B, ®Makrolex Green G, from Bayer, ®Sandoplast Blue 2B, ®Sandoplast Red BB, and ®Sandoplast Green G from Clariant, ®Mikrolit Violet BK from Ciba.

25 Furthermore, preferred additives include IR absorbers. These include, inter alia, IR-Absorber 2052 from Bayer.

Furthermore, the polymethyl methacrylate shaped body
30 can comprise spherical particles. For the purposes of the present invention, the term spherical means that the particles preferably have a ball-like shape, it being obvious to the person skilled in the art that, due to the preparation methods, particles with a
35 different shape may also be present, or that the shape of the particles can deviate from the ideal ball shape.

Accordingly, the term spherical means that the ratio of the largest dimension of the particles to the smallest

dimension is at most 4, preferably at most 2, these dimensions in each case being measured through the centre of gravity of the particles. Preferably at least 70%, particularly preferably at least 90%, based on the number of particles, are spherical.

The particles preferably have an average diameter (weight-average) in the range from 5 to 50 μm , preferably in the range from 8 to 25 μm . More favorably, 75% of the particles are in the range from 5 to 35 μm .

These particles may, for example, be made of inorganic materials, in particular of BaSO_4 or plastic, preference being given to plastic particles. In this connection, the refractive index of the particles has a refractive number n_0 measured at the Na-D line (589 nm) and at 20°C which differs from the refractive number n_0 of the matrix plastic by 0.02 to 0.2 unit.

The spherical plastic particles preferably comprise crosslinked polystyrene and/or crosslinked poly(meth)acrylates.

Mixtures from which the plastic particles are prepared particularly preferably have at least 80% by weight of styrene and at least 0.5% by weight of divinylbenzene.

The preparation of crosslinked plastic particles is known in the specialist field. For example, the scatter particles can be prepared by emulsion polymerization, as described, for example, in EP-A 342 283 or EP-A 269 324, very particularly preferably by polymerization in organic phase, as described, for example, in German Patent Application P 43 27 464.1, where, in the case of the last-mentioned polymerization technique, particularly narrow particle size distributions or, put another way, particularly small

deviations of the particle diameters from the average particle diameter, arise.

5 The polymethyl methacrylate shaped body can comprise, for example, 2 to 50% by weight, preferably 4 to 10% by weight, of particles which develop a scattering effect.

10 As a result of this, a reduction in the dazzling effect by solar irradiation can surprisingly be achieved without tanning of the skin being impaired too much. This preferred embodiment of the tanning aid according to the invention is particularly suitable for applications in which a dazzling effect of the sun is to be reduced.

15 According to a particular aspect of the present invention, the polymethyl methacrylate shaped body has an impact strength of at least 20 kJ/m² measured in accordance with DIN 53453 (standard test piece). To
20 improve this mechanical property, known impact-resistance modifiers in particular can be used.

Preferred impact-resistant molding materials which can be used to produce the polymethyl methacrylate shaped
25 body comprise 1 to 30, preferably 2 to 20, particularly preferably 3 to 15, in particular 5 to 12, % by weight of an impact-resistance modifying agent, which constitutes an elastomer phase of crosslinked polymer particles.

30 The impact-resistance modifying agent can be obtained in a manner known per se by bead polymerization or by emulsion polymerization.

35 Preferred impact-resistance modifying agents represent crosslinked particles with an average particle size in the range from 50 to 1000 nm, preferably 60 to 500 nm and particularly preferably 80 to 120 nm.

Particles of this type can be obtained, for example, by the free-radical polymerization of mixtures which generally at least 40% by weight, preferably 50 to 70% by weight, of methyl methacrylate, 20 to 80% by weight, preferably 25 to 35% by weight, of butyl acrylate, and 0.1 to 2% by weight, preferably 0.5 to 1% by weight, of a crosslinking monomer, e.g. a multifunctional (meth)acrylate, such as, for example, allyl methacrylate and comonomers which can be copolymerized with the abovementioned vinyl compounds.

The preferred comonomers include, inter alia, C₁-C₄-alkyl (meth)acrylates, such as ethyl acrylate or butyl methacrylate, preferably methyl acrylate, or other vinylically polymerizable monomers, such as, for example, styrene. The mixtures for the preparation of the abovementioned particles may preferably comprise 0 to 10% by weight, preferably 0.5 to 5% by weight, of comonomers.

Particularly preferred impact-resistance modifying agents are polymer particles which have a two-layer, particularly preferably a three-layer, core-shell construction. Such core-shell polymers are described, inter alia, in EP-A 0 113 924, EP-A 0 522 351, EP-A 0 465 049 and EP-A 0 683 028.

Particularly preferred impact-resistance modifiers based on acrylate rubber have, inter alia, the following construction:

Core: Polymer with a methyl methacrylate fraction of at least 90% by weight, based on the weight of the core.

Shell 1: Polymer with a butyl acrylate fraction of at least 80% by weight, based on the weight of the first shell.

Shell 2: Polymer with a methyl methacrylate fraction of at least 90% by weight, based on the weight of the second shell.

As well as comprising the specified monomers, the core and the shells may in each case comprise further monomers. These have been described above, particularly preferred comonomers having a crosslinking effect.

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For example, a preferred acrylate rubber modifier may have the following construction:

Core: Copolymer of methyl methacrylate (95.7% by weight), ethyl acrylate (4% by weight) and allyl methacrylate (0.3% by weight)

S1: Copolymer of butyl acrylate (81.2% by weight), styrene (17.5% by weight) and allyl methacrylate (1.3% by weight)

S2: Copolymer of methyl methacrylate (96% by weight) and ethyl acrylate (4% by weight)

10 The ratio of core to shell(s) in the acrylate rubber modifier may vary within wide ranges. The weight ratio of core to shell C/S is preferably in the range from 20:80 to 80:20, preferably from 30:70 to 70:30 to modifiers with one shell, and the ratio of core to
15 shell 1 to shell 2 C/S1/S2 is in the range from 10:80:10 to 40:20:40, particularly preferably from 20:60:20 to 30:40:30 in the case of modifiers with two shells.

20 The particle size of the core-shell modifiers is usually in the range from 50 to 1000 nm, preferably 100 to 500 nm and particularly preferably from 150 to 450 nm, without being limited thereby.

25 According to a particular embodiment, the polymethyl methacrylate shaped body has a modulus of elasticity of

at least 2800 N/mm², preferably at least 3300 N/mm² according to ISO 527/2.

5 The thickness of the polymethyl methacrylate shaped body can be within a wide range depending on the intended use. In general, this shaped body has a thickness in the range from 1 to 200 mm, preferably 2 to 20 mm.

10 The surface of the tanning aids may appear shiny or matt. According to a particular embodiment, the tanning aids may be equipped with a satin surface.

15 The size of the tanning aid can be adapted to the requirements. Thus, for example, roofs may be several 100 m² in size or smaller screens may comprise merely 1 to 2 m².

20 The invention is explained in more detail below using examples and comparative examples, without the intention being to limit the invention to these examples.

Example 1

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A polymethyl methacrylate panel with a thickness of 3 mm was produced in a casting process. For this, 994.208 g of syrup (mixture of methyl methacrylate/polymethyl methacrylate with 8 to 10% conversion),
30 0.039 g of @Mikrolit Violet BK, 0.03 g of Solvaperm Red BB, 0.200 g of @Sanduvor VSU, obtainable from Clariant, 5 g of @Tinuvin 770 DF obtainable from Ciba Geigy and 0.55 g of 2,2-azodi(isobutyronitrile) (AIBN, from Akzo Nobel were mixed and poured into a casting glass mold.
35 This mold was heated at 77°C for 150 minutes.

The panel obtained in this way exhibited a UV transparency at 380 nm of 74.42% and at 330 nm a transmission of 4.85%. The calculated effective

irradiation intensity was 12.2 mW/m^2 .

5 The effective irradiation intensity can be calculated via the erythema function, which is expressed the efficiency of ultraviolet radiation for producing reddening of human skin. The evaluation is carried out by multiplying the transmitted irradiation spectrum by the erythema function.

10 The irradiation spectrum arises from the solar spectrum in accordance with standard DIN 67501. Integration of the evaluated spectrum over the wavelength gives the effective irradiation intensity, where the effectiveness refers to the efficacy for producing
15 sunburn. The original solar spectrum has an effective irradiation intensity of about 250.9 mW/m^2 .

Example 2

20 Example 1 was essentially repeated but using a mixture comprising 975.0616 g of syrup, 0.20 g of @Sanduvor VSU, 5.00 g of @Tinuvin 770 DF and 0.5 g of AIBN and 19.2384 g of a mixture consisting of 8.64173 g of @Makrolex Orange 3G, 15.58967 g of @Makrolex Violet 3R,
25 238.70890 g of @Mikrolit Green GK 10%, 1.32260 g of @Thermoplast Yellow R 154, 9735.73170 g of paste base, in each case based on 10 000 g. The paste base consists of 83.25% by weight of dioctyl phthalate, 1.25% of Catafor CA 100, 5.5% castor oil 10% Aerosil R 972.

30 The panel obtained in this way exhibited a UV transparency at 380 nm of 46.19% and at 330 nm a transmission of 0.06%. The calculated effective irradiation intensity was 4.6 mW/m^2 .

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Example 3

Example 2 was essentially repeated, but using a mixture which comprised 868.80 g of MMA, 120.00 g of @Plex 4065

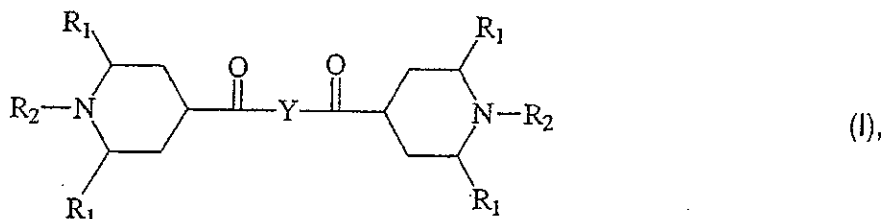
obtainable from Röhm GmbH & Co. KG, 5.50 g of Sandoplast Blue 2G 1% strength obtainable from Clariant, 0.20 g of @Sanduvor VSU, 5.00 g of @Tinuvin 770 DF and 0.5 g of AIBN.

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The panel obtained in this way exhibited a UV transparency at 380 nm of 51.18% and at 330 nm a transmission of 3.34%. The calculated effective irradiation intensity was 8.5 mW/m².

We claim:

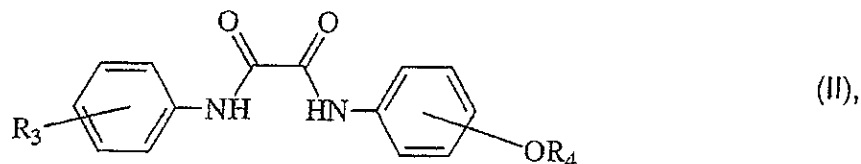
1. A tanning aid, characterized in that the tanning aid comprises a polymethyl methacrylate shaped body which comprises 0.1 to 1.5% by weight of a UV stabilizer containing 2,2,6,6-tetraalkylpiperidyl groups and which, dissolved in MMA at a concentration of 1% by weight, exhibits a transmission of at least 95% at 330 nm and the polymethyl methacrylate shaped body comprises 0.005 to 0.1% by weight of a UV absorber which, dissolved in MMA at a concentration of 0.02% by weight, exhibits a transmission of at most 5% at 320 nm and a transmission of at least 80% at 370 nm, where the transparency of the polymethyl methacrylate shaped body at 380 nm is at least 40%.
2. The tanning aid as claimed in claim 1, characterized in that the UV stabilizer is a compound according to formula (I)



in which the radicals R_1 are an alkyl group having 1 to 6 carbon atoms, R_2 is a hydrogen atom or an alkyl group having 1 to 6 carbon atoms and Y is a linking alkylene group having 2 to 20 carbon atoms.

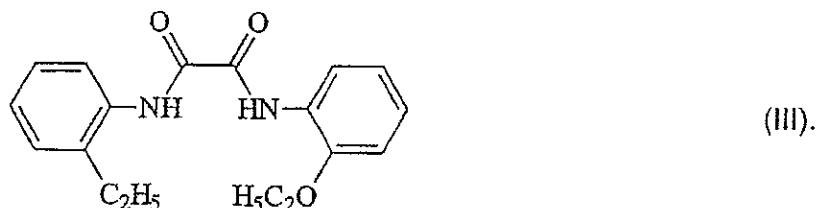
3. The tanning aid as claimed in claim 2, characterized in that the UV stabilizer is bis(2,2,6,6-tetramethyl-4-piperidyl) sebacate.
4. The tanning aid as claimed in one of the preceding claims, characterized in that the UV stabilizer is

a compound according to formula (II)



in which the radicals R_3 and R_4 , independently, are
an alkyl radical having 1 to 20 carbon atoms.

5. The tanning aid as claimed in one of the preceding
claims, characterized in that the UV absorber is
the compound according to formula (III)



6. The tanning aid as claimed in one of the preceding
claims, characterized in that the plastic shaped
body additionally comprises dyes which, dissolved
in MMA at a concentration of 0.01% by weight,
exhibit a transmission of at least 30% at 350 nm.
7. The tanning aid as claimed in one of the preceding
claims, characterized in that the transparency of
the polymethyl methacrylate shaped body at 400 nm
is at least 30%.
8. The tanning aid as claimed in one of the preceding
claims, characterized in that the transparency of
the polymethyl methacrylate shaped body at 330 nm
is at most 30%.
9. The tanning aid as claimed in one of the preceding
claims, characterized in that the ratio of
transparency of the polymethyl methacrylate shaped

body at 400 nm to the transparency at 330 nm is at least 20.

- 5 10. The tanning aid as claimed in one of the preceding claims, characterized in that the polymethyl methacrylate shaped body comprises an IR absorber.
- 10 11. The tanning aid as claimed in one or more of the preceding claims, characterized in that the polymethyl methacrylate shaped body has an impact resistance of at least 20 kJ/m².
- 15 12. The tanning aid as claimed in one or more of the preceding claims, characterized in that the polymethyl methacrylate shaped body has a thickness in the range from 1 to 200 mm.
- 20 14. The tanning aid as claimed in one or more of the preceding claims, characterized in that the polymethyl methacrylate shaped body has an E modulus of at least 2800 N/mm².
- 25 15. The tanning aid as claimed in one of the preceding claims, characterized in that the polymethyl methacrylate shaped body comprises spherical particles.
- 30 16. The use of polymethyl methacrylate shaped bodies having a transparency at 380 nm of at least 40% as tanning aid.