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(71) Applicant: **SYMRISE AG** [DE/DE]; Mühlenfeldstraße 1, 37603 Holzminden (DE).

(72) Inventors: **ROMEU, Xavier**; c/Can Pujolet 13 20n, 08032 Barcelona (ES). **GENRICH, Florian**; Greener Gartenstraße 4, 37574 Einbeck (DE). **PILLAI, Ravikumar**; 19 Lambert trail, Mahwah, NJ 07430 (US). **LÓPEZ, Mirela**; Rambla del Carmel 119-125, 2nd floor, 08032 Barcelona (ES).

(74) Agent: **FABRY, Bernd**; IP2 Patentanwalts GmbH, Schlossstraße 523-525, Mönchengladbach 41238 (DE).

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(54) Title: MIXTURES COMPRISING CLIMBAZOLE

(57) Abstract: The present invention belongs to the area of cosmetics, in particular hair cosmetics and refers to a mixture comprising (*RS*)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole), two 1,2-alkane diols, wherein the two 1,2-alkane diols comprise 5-10 carbon atoms and are not identical and 2-phenoxyethanol.

MIXTURES COMPRISING CLIMBAZOLE

FIELD OF INVENTION

[0001] The present invention belongs to the area of cosmetics, in particular hair cosmetics and refers to a mixture comprising (*RS*)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole), two 1,2-alkane diols, wherein the two 1,2-alkane diols comprise 5-10 carbon atoms and are not identical and 2-phenoxyethanol.

STATE OF THE ART

[0002] Dandruff is one of the most frequent skin problems, affecting more than 50% of men and women worldwide. The formation of dandruff can be triggered inter alia by the following factors:

- by functional disturbances of the sebaceous glands caused by hereditary factors,
- by diseases of internal organs or a disturbance in their functioning,
- as a side-effect of medicaments,
- by stress, strain on the nerves and psychological problems,
- by drying out of the scalp by unsuitable care products, bacteria and fungi, and
- by increased sebum production by the scalp.

[0003] Dandruff in most cases forms as a result of overproduction of horny cells. This overproduction is triggered by tiny centers of inflammation of the scalp, which are visible only under a microscope. Because of the inflammation, the horny cells of the scalp do not mature fully, so that they are shed prematurely in large cell structures - as dandruff.

[0004] A frequent cause of dandruff formation is increased colonisation with bacteria or fungi. *Malassezia* species, such as, for example, *Malassezia furfur* or *Malassezia globosa*, are of particular relevance here.

[0005] When treating increased dandruff formation, attempts are made, for example, to remove the dandruff, to reduce the overproduction of horny cells and/or to inhibit the growth of fungi. There are used, inter alia, salicylic-acid-containing therapeutic agents, antimycotics having good activity against *Malassezia* species, tar-containing externals, sulfur and/or selenium disulfide.

[0006] Inhibiting the growth of fungi of the genus *Malassezia* is one of the main methods of controlling dandruff formation. An important group of active ingredients that are currently being used in the treatment of dandruff are antimycotics for topical and systemic admin-

istration from the group of the azoles, preferred anti-dandruff agents are e.g. climbazole as well as further azoles.

[0007] Climbazole (*RS*)-1-(4-chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one is usually used in anti-dandruff and anti-fungal products, including shampoos, lotions and conditioners. Its chemical structure and properties are similar to other fungicides such as ketoconazole and miconazole. At ambient temperature climbazole is a crystalline solid with low solubility in water, but higher solubility in alcohol, glycols, surfactants and certain perfume oils.

[0008] When using climbazole in the hair care area, which usually comprises mostly water as the main component, it is difficult to bring climbazole into solution, because often heating processes are not available technically. Thus, it was an object of the present invention to simplify the manufacture of hair care products by cold process involving climbazole. Therefore, an object of the present invention was to develop a liquid blend comprising climbazole for the manufacture of hair care products, wherein the dissolving step is eliminated from the manufacture process.

[0009] It was a further object of the present invention to provide a mixture comprising climbazole and the said component (single substance or mixture of substances) that provides improved solubility of climbazole in water, as a semi-finished product which is preferably clear, colourless or transparent and does not impact the end product's viscosity and foamability in a negative way, thus the mixture is suitable for the production of the end product, which is preferably a hair care product. Accordingly, the said mixture (or semi-finished product) should be universally suitable especially for the cold production of hair care products, where heating is not possible.

[0010] One of the main objects of the present invention relates to the stability of the said mixture (semi-finished product), which should show good storage stability until the mixture is used for the production of the end product, especially without a recrystallization of climbazole during a long-term storage time.

[0011] In addition the said mixture (semi-finished product) should if at all possible not have an unpleasant odour or should not impart an unpleasant odour to the cosmetic and product.

DESCRIPTION OF THE INVENTION

[0012] A first object of the present invention is a mixture comprising:

(i) (*RS*)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole),

(ii) two 1,2-alkane diols, wherein the two 1,2-alkane diols comprise 5-10 carbon atoms and are not identical,

(ii) 2-phenoxyethanol.

[0013] Surprisingly, it has been observed that such a described mixture, comprising compounds (i), (ii) and (iii) achieved the above mentioned object of the present invention. In particular, it has been surprisingly observed, that although 2-phenoxyethanol which is known to be a preservative only shows moderate action activity against some micro-organisms, such as *Aspergillus brasiliensis* (ATCC 16404), but in combination with said

compounds (i) and (ii) there is a high efficacy against a series of micro-organisms, including *Aspergillus brasiliensis* (ATCC 16404).

[0014] Another embodiment of the present invention relates to the said mixture, wherein the two 1,2-alkane diols are a combination selected from:

a) 1,2-pentanediol and 1,2- octanediol,

b) 1,2-pentanediol and 1,2- decanediol,

c) 1,2-hexanediol and 1,2-octanediol,

d) 1,2-hexanediol and 1,2- decanediol.

[0015] The specific combinations of 1,2-alkane diols of the invention in combination with 2-phenoxyethanol have been observed to be especially effective to keep climbazole soluble, respectively improve the solubility of climbazole for cosmetic products formulation. In particular the combination of a long-chain 1,2-alkane diol with a short-chain 1,2-alkane diol is advantageously for the improvement of the phase relationship, especially in case of an oil-in-water or water-in-oil emulsion. Thus, the solubility of climbazole can be increased through the improved phase relationship.

[0016] A further embodiment of the present invention refers to the said mixture, wherein

a) the ratio of 1,2-pentanediol and 1,2- octanediol is from 1:5 to 5:1, preferably 1:1 to 1:5 or 1:1 to 5:1;

b) the ratio of 1,2-pentanediol and 1,2- decanediol is from 1:5 to 5:1, preferably 1:1 to 1:5 or 1:1 to 5:1;

c) the ratio of 1,2-hexanediol and 1,2- octanediol is from 1:5 to 5:1, preferably 1:1 to 1:5 or 1:1 to 5:1;

d) the ratio of 1,2-hexanediol and 1,2- decanediol is from 1:5 to 5:1, preferably 1:1 to 1:5 or 1:1 to 5:1.

[0017] Within the mentioned ratios, the combinations of 1,2-alkane diols a) to d) of the invention are advantageously used to achieve (besides the ability to dissolve climbazole), to not have negative impact on viscosity and foam ability of the final cosmetic product.

[0018] In a further embodiment of the present invention the said mixture comprises:

(i) 25 w.t.% to 40 w.t.% (RS)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole),

(ii) 2 w.t.% to 35 w.t.% of the total weight of the two 1,2-alkane diols,

(iii) 35 w.t.% to 55 w.t.% 2-phenoxyethanol,

wherein the percentages by weight refer to the total weight of the mixture.

[0019] Preferably the total amounts of the 1,2-alkane diols in the mixture is from 2% to 35 % by weight, preferably 3% to 30% by weight, more preferably 5% to 20.5% by weight, each based on the total weight of the total composition.

[0020] Preferably the two 1,2-alkane diols are a combination of 1,2-hexanediol and 1,2-decanediol or 1,2-pentanediol and 1,2- decanediol . This combination of 1,2-alkane diols are

particularly preferred, because they are most advantageous to achieve the above mentioned object, in particular in aspects of the antimicrobial efficacy but also storage stability.

[0021] 1,2- Decanediol is waxy at room temperature. A mixture of 1,2-pentanediol or 1,2-hexanediol in combination with 1,2- decanediol and 2-phenoxyethanol, which function as solubilizer as well as possess antimicrobial character, can be used with (RS)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole) to prepare hair care products by a cold process.

[0022] Basically, (*RS*)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole) is known to be antimycotic, but within the mixture of the present invention there is a synergistic effect against micro-organism, that allow an improved preservation.

[0023] Thus, an embodiment of the present invention is the used of the mixture comprising as a preservative preparation for cosmetic products.

[0024] According to the present invention the preferred alternatives of the two 1,2-alkane diols are to be applied to all subject-matters of the present invention.

[0025] A further object of the present invention is a semi-finished product for hair care products, comprising the above mentioned mixture according to the invention.

[0026] The semi-finished product in this context refers to a composition (mixture) containing the certain described ingredients (i), (ii) and (iii) from which the end-product composition (is obtained) by adding one or more components thereto, preferably cosmetically acceptable ingredients and additives. The semi-finished product is preferably a concentrate, which is typically used within the end-product in a range from 0.5 % to 5 % by weight, preferably from 0.8% by weight to 3% by weight, more preferably from 1.0% to 2% usually in combination with further ingredients and additives.

[0027] Another object of the present invention is therefore a hair care product comprising the above mentioned mixture or the semi-finished product according to the invention.

[0028] The hair care product is preferably a hair care product selected from both leave-on and wash-off category selected from: shampoo (e.g. 2-in 1 shampoo, anti-dandruff shampoo, shampoo for dry scalp, shampoo concentrate), hair conditioners, hair cure, hair coloring, hair rinse, hair styling products (gel, mousse, foam, wax, spray), relaxer, straightener, hair oil, scalp cream. Hair mask, hair tonic, serum.

[0029] Surprisingly, it has been observed that the end products, here hair care products can be manufactured with the mixture and semi-finished product of the present invention without heating and climbazole is still soluble. Further, there is no climbazole precipitate after a long-term storage time at ambient temperature.

[0030] The mixtures and semi-finished products according to the invention permit the production of hair care products, especially shampoos with good storage stability, preferably over a period of 3 months, in particular over a period of 9 months.

[0031] The storage stability of the mixtures and compositions according to the invention was characterized in that no crystallization of climbazole, demixing or phase separation was observed during the storage time of 3 or preferably 6 months in daylight and at constant storage temperature, preferably at a constant storage temperature of room temperature,

preferably at a constant storage temperature of 40°C and/or 50°C, in particular preferably at a constant storage temperature of 4°C.

[0032] In addition, mixtures and compositions according to the invention have good stability, i.e. no, no substantial or, only in exceptional cases, slight, insignificant changes were observed in the aforementioned storage conditions and times with respect to viscosity, pH value, color and odor.

[0033] A further object of the present invention is a method of

(i) increasing the solubility of (*RS*)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethyl-butan-2-one (climbazole) and/or

(ii) decreasing the turbidity of a mixture comprising (*RS*)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole) and/or

(iii) increasing transparency of a mixture comprising (*RS*)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole),

comprising the step of: mixing (*RS*)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole) with

a) two 1,2-alkane diols, wherein the two 1,2-alkane diols comprise -10 carbon atoms and are not identical, and

b) 2-phenoxyethanol,

to obtain a mixture according to the present invention as described above.

[0034] Another object of the present invention is the use of a combination of two 1,2-alkane diols, wherein the two 1,2-alkane diols comprise 5-10 carbon atoms and are not identical, and 2-phenoxyethanol to increase the solubility of climbazole, especially in water-based or containing systems.

[0035] Another object of the present invention is the use of a combination of two 1,2-alkane diols, wherein the two 1,2-alkane diols comprise 5-10 carbon atoms and are not identical, and 2-phenoxyethanol as solubilizer for climbazole, especially in water-based or containing system.

[0036] Preference is given to the use according to the invention, wherein the two 1,2-alkane diols are a combination selected from:

a) 1,2-pentanediol and 1,2- octanediol,

b) 1,2-pentanediol and 1,2- decanediol,

c) 1,2-hexanediol and 1,2-octanediol,

d) 1,2-hexanediol and 1,2- decanediol.

[0037] Preference is given to the use according to the invention, wherein the two 1,2-alkane diols are used

a) the ratio of 1,2-pentanediol and 1,2- octanediol is from 1:5 to 5:1, preferably 1:1 to 1:5 or 1:1 to 5:1;

b) the ratio of 1,2-pentanediol and 1,2- decanediol is from a) 1:5 to 5:1, preferably 1:1 to 1:5 or 1:1 to 5:1;

c) the ratio of 1,2-hexanediol and 1,2- octanediol is from a) 1:5 to 5:1, preferably 1:1 to 1:5 or 1:1 to 5:1;

d) the ratio of 1,2-hexanediol and 1,2- decanediol is from a) 1:5 to 5:1, preferably 1:1 to 1:5 or 1:1 to 5:1.

[0038] A mixture or semi-finished product according to the invention is characterized by, that climbazole is soluble and among other things:

- does not significantly impact end product's viscosity,
- does not significantly impact end product's pH value,
- shows good temperature stability,
- does not significantly impact end product's foamability,
- good color stability.

[0039] The mixture and semi-finished product according to the invention are used particularly in cosmetic preparations, especially in hair care products. Such a preparation can be provided in form of an emulsion, solution, lotion, fluid, cream, micro-emulsion, gel (e.g. hydrogel or hydrodispersion gel).

[0040] The mixture and semi-finished product according to the invention are usually used in cosmetic preparations, especially in hair care products in such a way that (RS)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole) is not more than 0,5 w.t.% in the cosmetic preparation, based on the total amount of the preparation.

[0041] A hair care product preferred according to the invention is characterized in that the hair care preparation comprises:

a) about 0,5% by weight to about 1,5 % by weight of the inventive mixture, which preferably comprises 2-phenoxyethanol, climbazole, 1,2-hexanediol, 1,2-decanediol;

b) about 20 % by weight to about 30 % by weight anionic surfactant, preferably sodium laurethsulfate;

c) about 8 % by weight to about 20 % by weight amphoteric surfactant, preferably cocamidopropyl betaine;

d) about 1 % by weight to about10 % by weight emulsifier, preferably PEG-6 Caprylic/Capric glycerides;

e) about 0,5 % by weight to about 10 % by weight non-ionic surfactant, preferably decyl glucoside;

f) about 0,03 % by weight to about 2 % by weight perfume;

g) about 0,05 % by weight to about 2 % by weight Polyquaternium-10;

h) about 0,05 % by weight to about 5 % by weight salt, preferably sodium chloride,

and water, wherein all compounds a-h and water add to 100% by weight of the total composition.

[0042] The hair care preparation in which the mixture, respectively the semi-finished product is formulated usually comprises further cosmetic ingredients, auxiliaries and additives, such as antidandruff agents, anti-inflammatory agents, irritation-preventing agents, irritation-inhibiting agents, antioxidants, antiseptic agents, ant-statics, binders, buffers, carrier materials, chelating agents, cell stimulants, cleansing agents, care agents, surface-active substances, emulsifiers, enzymes, essential oils, fibres, film-forming agents, fixatives, foam-forming agents, foam stabilizers, gelling agents, gel-forming agents, hair care agents, hair-setting agents, hair-straightening agents, moisture-donating agents, moisturizing substances, moisture-retaining substances, bleaching agents, strengthening agents, opacifying agents, polish, gloss agents, polymers, powders, proteins, re-oiling agents, silicones, hair promotion agents, cooling agents, stabilizers, UV-absorbing agents, UV filters, thickeners, vitamins, oils, waxes, fats, phospholipids, saturated fatty acids, mono- or polyunsaturated fatty acids, α-hydroxy acids, polyhydroxyfatty acids, liquefiers, dyestuffs, colour-protecting agents, pigments, aromas, flavouring substances, odoriferous substances, polyols, surfactants, electrolytes, organic solvents or silicone derivatives and the like as additional auxiliaries and additives.

[0043] Preferably a shampoo preparation of the present invention comprises

(a) a phase A comprising the inventive mixture of

(i) (*RS*)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole),

(ii) two 1,2-alkane diols, wherein the two 1,2-alkane diols comprise 5-10 carbon atoms and are not identical, and

(iii) 2-phenoxyethanol,

(b) a surfactant phase B, comprising at least one surfactant and

(c) a water phase C.

[0044] In a preferred embodiment of the invention such a shampoo preparation may consists of the compounds listed in **Table A**, but should not be limited to.

Table A

PHASE:	INGREDIENT:	Amounts [% by weight]
Phase A:	Inventive mixture	1,50
Phase B:	Sodium laurethsulfate (27% in water)	27,00
	Cocamidopropyl betaine (30% in water)	12,00
	PEG-6 Caprylic/Capric glycerides	2,50
	Decyl glucoside	2,00
	Perfume	0,50
Phase C:	Water	53,60
	Polyquaternium-10	0,40
	Sodium chloride	0,50

[0045] Another object of the present invention is a process for the manufacture of a cold process shampoo, comprising the steps of:

a) mixing all ingredients of a surfactant phase B, and

b) adding water phase C step by step under well agitation to the mixture from step a),

c) adding the inventive mixture (phase A), comprising

(i) (*RS*)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole),

(ii) two 1,2-alkane diols, wherein the two 1,2-alkane diols comprise 5-10 carbon atoms and are not identical,

(iii) 2-phenoxyethanol

to the blend of step b), characterized in that the temperature is not elevated intentionally by external heating during the process.

[0046] A surfactant phase B is understood to comprise at least one surfactant, preferably more than one kind of surfactants.

[0047] Preferred auxiliaries and additives are anionic and/or amphoteric or zwitterionic surfactants. Typical examples of anionic surfactants are soaps, alkyl benzenesulfonates, alkanesulfonates, olefin sulfonates, alkylether sulfonates, glycerol ether sulfonates, methyl ester sulfonates, sulfofatty acids, alkyl sulfates, fatty alcohol ether sulfates, glycerol ether sulfates, fatty acid ether sulfates, hydroxy mixed ether sulfates, monoglyceride (ether) sulfates, fatty acid amide (ether) sulfates, mono- and dialkyl sulfosuccinates, mono- and dialkyl sulfosuccinamates, sulfotriglycerides, amide soaps, ether carboxylic acids and salts thereof, fatty acid isethionates, fatty acid sarcosinates, fatty acid taurides, N-acylamino acids such as, for example, acyl lactylates, acyl tartrates, acyl glutamates and acyl aspartates, alkyl oligoglucoside sulfates, protein fatty acid condensates (particularly wheat-based vegetable products) and alkyl(ether) phosphates. If the anionic surfactants contain polyglycol ether chains, they may have a conventional homolog distribution although they preferably have a narrow-range homolog distribution. Typical examples of amphoteric or zwitterionic surfactants are alkylbetaines, alkylamidobetaines, aminopropionates, aminoglycinates, imidazolinium betaines and sulfobetaines. The surfactants mentioned are all known compounds. Information on their structure and production can be found in relevant synoptic works, cf. for example J. Falbe (ed.), "Surfactants in Consumer Products", Springer Verlag, Berlin, 1987, pages 54 to 124 or J. Falbe (ed.), "Katalysatoren, Tenside und Mineralöladditive (Catalysts, Surfactants and Mineral Oil Additives)", Thieme Verlag, Stuttgart, 1978, pages 123-217. The percentage content of surfactants in the preparations may be from 0.1 to 20% by weight and is preferably from 0.5 to 5% by weight, based on the preparation.

[0048] The surfactant phase can comprises further ingredients such as perfume and further cosmetically acceptable additives.

[0049] A water phase is understood to comprise water as the main component, but can also comprise further ingredients such as salts or further cosmetically acceptable additives.

EXAMPLES

[0050] EXAMPLE 1

[0051] Preparations comprising various combinations of the two 1,2-alkane diols and an amount of about 33.3 w.t.% of climbazole and an amount of 46.6 w.t.% have been prepared.

[0052] **Table 1**
Formulation A-H

Mixture	A	B	C	D	E	F	G	H
1,2-pentanediol	4.3	12.7			7.1	12.5		
1,2-hexanediol			6.7	12.0			4.6	12.6
1,2- octanediol	15.2	7.2					17.0	7.8
1,2- decanediol			13.4	8.1	13.0	7.8		

[0053] EXAMPLE 2
Storage Test

[0054] The above mixture C has been stored at the following constant temperatures for a period of 1, 3, 6 and 9 months. The results are represented in **Table 2**.

[0055] **Table 2**
Results of the storage test

Temperature 4°C				
	1	**3**	**6**	**9**
	White solid phase + liquid clear phase, turns to homogeneous liquid when is kept at RT	White solid phase + liquid clear phase, turns to homogeneous liquid when is kept at RT	White solid phase + liquid clear phase, turns to homogeneous liquid when is kept at RT	White solid phase + liquid clear phase, turns to homogeneous liquid when is kept at RT
Temperature RT				
	1	**3**	**6**	**9**
	Clear, colourless	Clear, colourless	Clear, colourless	Clear, colourless
Temperature 40°C				
	1	**3**	**6**	**9**
C	Clear, colourless	Clear, very slightly yellowish	Clear, very slightly yellowish	Clear, very slightly yellowish

[0056] EXAMPLE 3

Stability in shampoo

[0057] Mixture c from Example 1 has been formulated into commonly used shampoo (see table 6). The stability of the preparations has been observed as described in example 2.

Table 3
Stability in shampoo

Storage Time							
	1 month		**2 months and a half**			**3 months**	
Temp.				**pH**			**pH**
4°C	White, no change		White, no change	7,49		White, no change	7,49
RT	White, no change		White, no change	7,38		White, no change	7,51
40°C	Slightly yellowish		Slightly less yellowish, separation of the pearlizer agent	7,52		Slightly less yellowish, separation of the pearlizer agent	7,83

[0058] EXAMPLE 4

Viscosity and foamability test

Mixture c from Example 1 was formulated in a shampoo (table 6).

The pH, viscosity and the foamability of the preparation is determined as follows.

[0059] a) Viscosity Procedure

Turn on the Viscometer. Select the Spindle according to the expected viscosity of the formulation. Screw the spindle to the viscometer. Make sure the spindle is at center of the container and there is no foam floating on the surface. Adjust the container height to reach the spindle's groove. Press 'Set Speed' button. Press 'On' button and the viscometer will start spinning. Wait for 15 seconds until CP value stabilize and note it down on the log sheet.

[0060] b) Measurement of pH

Turn on the pH-meter. Take the electrode out of the storage container, rinse the electrode with distilled or deionised water, and dry it out with clean, absorbent laboratory wipe. Place the pH probe into the container holding the sample so that the pH glass membrane at the end of the probe is completely submerged and wait until the pH value is constant. Press the "Read" button on the pH meter and record the pH value when the measurement process ceases. Take the electrode off the solution, wash with distilled or deionised water or ethanol, dry it out with wipe and put it back into the storage container.

[0061] c) Foam studies

The foamability and foam stability of the solutions was conducted by means of the following hand shaking method using a closed test tube containing a ½ water solution of the surfactant formulation and ½ free space (air) by volume. It was studied three different shampoo blends. Each shampoo formulation was tested in three different versions (first trial with 0.5% climbazole and 1% of a mixture comprising phenoxyethanol, methylparaben, ethylparaben, polyparaben and butylparaben, - second trial with 1.5% climbazole, third trial with 1.5% of a mixture comprising phenoxyethanol, methylparaben, ethylparaben, polyparaben and butylparaben, in order to study the relationship between the different active ingredients and the foamability. To determine the concentration of the shampoo blends in water to be used in order to have an optimal reading of the foam volume, several trials were conducted firstly at 1.0%, 1.5% and 2.0%. Under these test conditions the concentration of 1.5% was chosen. The foam was generated by three vigorous shakings by up-downing by hand the closed test tube (100 mL total volume) containing 50 mL of 1.5% water solution of each shampoo blend. All foam tests, including shakings, were performed three times every two minutes until obtain the values of following parameters: total volume, liquid volume and foam volume. The foamability is characterized by the volume of foam immediately after shaking (t=0), and the volume of foam, still remaining in the test tube after a certain period of time (t>0).

[0062] The results of the pH, viscosity and foamability are represented below in **Tables 4 and 5:** There are no significant changes in comparison to the standard shampoo formulations. Thus, shampoos comprising the mixture of the present invention and shampoos without the inventive mixture show nearly the same viscosity, pH and foamability.

[0063] Table 4
Viscosity and pH

Formulation	**1**	**2**	**3**
pH	6.66	6.63	5.89
Viscosity / cPs	789.3	741.03	492.47

[0064] **Table 5**
Foamability of mixture c in shampoo formulations 1-3

Time / min	**Foam Volume / mL**		
Elapsed time after shaking	**1% of Blend**	**1.5% of Blend**	**2% of Blend**
Formulation 1			
2,00	32,0	45,0	42,0
4,00	42,5	50,0	50,0
6,00	42,5	55,0	55,0
Formulation 2			
2,00	25,0	40,5	35,0
4,00	40,0	40,5	47,0
6,00	51,0	51,5	60,0
Formulation 3			
2,00	30,0	30,0	36,0
4,00	40,0	40,0	50,0
6,00	45,0	52,0	50,0

[0065] **Table 6**
Mixture C in a shampoo formulation

Formulation		**1**	**2**	**3**
PHASE:	Ingredient (INCI)	w.t.%		
A	(*RS*)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one	0,50	0,00	0,00
	Phenoxyethanol, Methylparaben, Ethylparaben, Propylparaben, Butylparaben	1,00	0,00	1,50
	Mixture C	0,00	1,50	0,00
B	Sodium Laurethsulfate	27,00	12,00	12,00
	Cocamidopropylbetaine	12,00	3,00	3,00
	PEG-6 Caprylic/Capric Glycerides	2,50	12,00	12,00
	Decyl Glucoside	2,00	2,00	2,00
	Perfume	0,50	0,50	0,50
C	Water	53,60	43,60	43,60
	Polyquarternium-10	0,40	0,40	0,40
	Sodium chloride	0,50	0,50	0,50
	Total	100,00	100,00	100,00

[0066] **EXAMPLE 5**
Thaw circle test

[0067] Mixture c has been tested in a thaw circle test to determine the temperature stability of the mixture. Mixture c was tested three times, in which it has been firstly cooled down to -20°C for 24h and then brought to room temperature, where it has been kept for 24h, afterwards warming up to 40°C and kept for 24h at this temperature and then again cooled down to room temperature. This was done three times and the samples have been visually assed. The results are presented below in **Table 7**.

[0068] **Table 7**
Results of the thaw circle test

Circle	1	2	3
Temperature			
-20ºC	White solid phase, turns to homogeneous liquid when is kept at RT	White solid phase, turns to homogeneous liquid when is kept at RT	White solid phase, turns to homogeneous liquid when is kept at RT
RT	Clear, colorless	Clear, colorless	Clear, colorless
+40ºC	Clear, colorless	Clear, colorless	Clear, colorless
RT	Clear, colorless	Clear, colorless	Clear, colorless

[0069] **EXAMPLE 6**
Antimicrobial preservation

[0070] Mixture c from Example 1 was formulated into a shampoo (table 9) and was tested with various micro-organisms.

[0071] 20 g of sample aliquots were challenged with 0.2 ml of the preparations of inoculum of each test micro-organism. After homogenizing the challenged samples were stored at 25°C. The number of viable micro-organisms was determined at 2 days, 7 days, 14 days and 28 days after the challenge.

[0072] To determine the number of viable micro-organisms suitable dilutions of the challenged sample aliquots using NNP buffer containing inactivator No.5 prepared. These samples solutions were examined by pour plate method. For enumeration of bacteria and fungi Tryptic Soy agar (TSA) and Sabouraud agar (SAB), respectively, were used. TSA plates were incubated for 3-5 days at 30-35°C, Sabouraud agar plates were incubated at 20-25°C for 5 days.

[0073] Due to the results of the microbiological examination performed the efficacy of preservation complies with the requirements of Ph. Eur. criteria A and USP category 2 for topical preparations. The results are shown in **Table 8**:

[0074] **Table 8**
Results of antimicrobial preservation

Micro-organism	Inoculum (calculated)	CFU/g			
		2 days	7 days	14 days	28 days
Escherichia coli ATCC 8739	3.4×10^6	< 10	< 10	< 10	< 10
Pseudomonas aeruginosa ATCC 9027	2.9×10^6	< 10	< 10	< 10	< 10
Stapholococcus aureus ATCC 6538	2.5×10^6	< 10	< 10	< 10	< 10
Candida albicans ATCC 10231	2.1×10^6	< 10	< 10	< 10	< 10
Aspergillus brasiliensis ATCC 16404	2.2×10^6	< 10	< 10	< 10	< 10

[0075] It has been shown that starting from an inoculated amount of > 1.0x106 CFU/g after 2 days no micro-organisms can be detected anymore (complete inhibition). Additionally no recolonization can be observed within the following 28 days.

[0076] **Table 9**
Shampoo formulation (in % b.w.)

PHASE	INGREDIENT:	Amount
Phase A	Inventive mixture	1,50
Phase B:	Sodium laurethsulfate	10,00
	Cocamidopropylbetaine	2,00
	Cocamidopropyl betaine, Glycol Distearate, Laureth-4	2,00
	Cocamide DEA	2,50
	Perfume	0,50
Phase C:	Water	80,90
	Guar Hydroxypropyl Trimonium chloride	0,50
	Disodium EDTA	0,05
Phase D:	Citric acid	0,05
	Total	100,00

CLAIMS

1. A mixture comprising:
   (i) (RS)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole),
   (ii) two 1,2-alkane diols, wherein the two 1,2-alkane diols comprise 5-10 carbon atoms and are not identical,
   (iii) 2-phenoxyethanol.
2. The mixture of claim 1, wherein the two 1,2-alkane diols are a combination selected from:
   a) 1,2-pentanediol and 1,2- octanediol,
   b) 1,2-pentanediol and 1,2- decanediol,
   c) 1,2-hexanediol and 1,2- octanediol,
   d) 1,2-hexanediol and 1,2- decanediol.
3. The mixture of claim 2, wherein
   a) the ratio of 1,2-pentanediol and 1,2- octanediol is from 1:5 to 5:1;
   b) the ratio of 1,2-pentanediol and 1,2- decanediol is from 1:5 to 5:1;
   c) the ratio of 1,2-hexanediol and 1,2- octanediol is from 1:5 to 1:5;
   d) the ratio of 1,2-hexanediol and 1,2- decanediol is from 1:5 to 1:5.
4. The mixture of claim 1 to 3, wherein the mixture comprises:
   (i) 25 w.t.% to 40 w.t.% (RS)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethyl-butan-2-one (climbazole),
   (ii) 2 w.t.% to 35 w.t.% of the total weight of the two 1,2-alkane diols,
   (iii) 35 w.t.% to 55 w.t.% 2-phenoxyethanol,
   wherein the percentages by weight refer to the total weight of the mixture.
5. The mixture according to any preceding claims 1 to 4, wherein the two 1,2-alkane diols is a combination of 1,2-hexanediol and 1,2-decanediol.
6. A semi-finished product for hair care products, comprising the mixture of any proceeding claims 1 to 5.
7. A hair care product comprising a mixture according to any preceding claims 1 to 5 or the semi-finished product of claim 6.
8. The hair care product of claim 7, wherein the hair care products are selected from the group consisting of: shampoo (e.g. 2-in 1 shampoo, anti-dandruff shampoo, shampoo for dry scalp, shampoo concentrate), hair conditioners, hair cure, hair coloring, hair rinse, hair styling products (gel, mousse, foam, wax, spray), relaxer, straightener, hair oil, scalp cream, hair mask, hair tonic, serum.

9. A method of

(i) increasing the solubility of (RS)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole) and/or

(ii) decreasing the turbidity of a mixture comprising (RS)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole) and/or

(iii) increasing transparency of a mixture comprising (RS)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole),

comprising the step of:

mixing (RS)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole) with

a) two 1,2-alkane diols, wherein the two 1,2-alkane diols comprise 5-10 carbon atoms and are not identical, and

b) 2-phenoxyethanol,

to obtain a mixture according to any claims 1 to 5 or a semi-finished product according to claim 6.

10. The use of a combination of two 1,2-alkane diols, wherein the two 1,2-alkane diols comprise 5-10 carbon atoms and are not identical, and 2-phenoxyethanol to increase the solubility of (RS)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole).

11. The use of claim 10, wherein the two 1,2-alkane diols are a combination selected from:

a) 1,2-pentanediol and 1,2- octanediol,

b) 1,2-pentanediol and 1,2- decanediol,

c) 1,2-hexanediol and 1,2- octanediol,

d) 1,2-hexanediol and 1,2- decanediol.

12. The use of claims 10 or 11, wherein

a) the ratio of 1,2-pentanediol and 1,2- octanediol is from 1:5 to 1:5;

b) the ratio of 1,2-pentanediol and 1,2- decanediol is from 1:5 to 1:5;

c) the ratio of 1,2-hexanediol and 1,2- octanediol is from 1:5 to 1:5;

d) the ratio of 1,2-hexanediol and 1,2- decanediol is from 1:5 to 1:5.

13. A process for the manufacture of a cold process shampoo, comprising the steps of:

(a) mixing all ingredients of a surfactant phase B, and

(b) adding water phase C step by step under well agitation to the mixture from step a)

(c) adding the inventive mixture (phase A), comprising

(i) (*RS*)-1-(4-Chlorophenoxy)-1-imidazol-1-yl-3,3-dimethylbutan-2-one (climbazole),

(ii) two 1,2-alkane diols, wherein the two 1,2-alkane diols comprise 5-10 carbon atoms and are not identical,

(iii) 2-phenoxyethanol

to the blend of step b), characterized in that the temperature is not elevated intentionally by external heating during the process.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61K A61Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/215775 A1 (SCHMAUS GERHARD [DE] ET AL) 26 August 2010 (2010-08-26) tables ----	1,6-8
A	US 2013/136709 A1 (PILLAI RAVIKUMAR [US] ET AL) 30 May 2013 (2013-05-30) the whole document ----	1-13

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Donovan-Beermann, T

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2015/079537

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