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(54) Title: COMPOSITION

(57) Abstract: Hair styling composition comprising a styling active comprising polyimide-1 and a polyvinylmethyl ether/maleic acid, and a scleroprotein.

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COMPOSITION

The present invention relates to a styling composition comprising a styling polymer.

5

Despite the prior art there remains a need for improved styling compositions.

Accordingly, there is provided a hair styling composition according to claim 1.

10 Preferably, the styling active comprises polyimide-1 and a polyvinylmethyl ether/maleic acid (PVM/MA). More preferably, the styling active comprises one or more diols, where the diol/diols is/are an alkanediol having 4 to 16 carbon atoms, preferably 6 to 10 carbon atoms, preferably 6 to 8 carbon atoms, in the alkylene chain, in particular a butanediol, pentanediol, hexanediol, heptanediol, octanediol
15 or decanediol, preferably 1,2-butanediol, 1,2-pentanediol, 1,2-hexanediol, 1,2-heptanediol, 1,2-octanediol

The preferred styling active, polyimide-1 and PVM/MA copolymer (and) caprylyl glycol is commercially available as Styleze XT3® commercially available from ISP.

20

Preferably, the scleroprotein is selected from keratin, collagen, fibroin and elastin.

Preferably, the styling active is present at from 0.1 to 10% wt. of the composition, more preferably from 0.5 to 7% and most preferably from 2 to 5% by weight of the
25 composition.

Preferably, the scleroprotein is present at from 0.001 to 5% wt. of the composition.

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The compositions of the invention are especially effective in improving combing of bleached hair to which has been applied a composition comprising the hair styling active.

- 5 The compositions of the invention may optionally comprise from 0.001% to 10% by weight of a further hair styling polymer.

More preferred amounts of the further hair styling polymer in the compositions of the invention are from 0.1% to 5% by weight of the composition, even more
10 preferably from 0.5% to 3% by weight.

Such hair styling polymers are well known. Suitable further hair styling polymers include commercially available polymers that contain moieties that render the polymers cationic, anionic, amphoteric or nonionic in nature. Suitable hair styling
15 polymers include, for example, block and graft copolymers. The polymers may be synthetic or naturally derived.

Surfactant

20 The compositions of the invention may comprise surfactant in addition to that required for the preparation of any PSA emulsion. The surfactants which are suitable for use in the compositions of the invention may be nonionic, cationic, anionic, zwitterionic or a mixture of such surfactants depending on the product form.

25

The hair styling compositions of the invention preferably comprise a non-ionic surfactant, in an amount of up to 5%, preferably from 0.01% to 1%, most preferably from 0.02% to 0.8% by weight based on total weight.

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Examples of suitable non-ionic surfactants are condensation products of aliphatic (C₈-C₁₈) primary or secondary linear or branched chain alcohols or phenols with alkylene oxides, usually ethylene oxide and generally having at least 15, preferably at least 20, most preferably from 30 to 50 ethylene oxide groups. Other
5 suitable non-ionics include esters of sorbitol, esters of sorbitan anhydrides, esters of propylene glycol, fatty acid esters of polyethylene glycol, fatty acid esters of polypropylene glycol, ethoxylated esters and polyoxyethylene fatty ether phosphates.

10 Of particular use are those non-ionic surfactants of general formula R(EO)_x H, where R represents a straight or branched chain alkyl group having an average carbon chain length of 12-18 carbon atoms and x ranges from 30 to 50. Specific examples include steareth-40, steareth-50, cetareth-30, cetareth-40, cetareth-50 and mixtures thereof. Suitable commercially available examples of these
15 materials include Unicol SA-40 (Universal Preserv-A-Chem), Empilan KM50 (Albright and Wilson), NONION PS-250 (Nippon Oils & Fats), Volpo CS50 (Croda Inc), and Incropol CS-50 (Croda Inc).

Water

20 Compositions of the present invention can also include water, preferably distilled or de-ionised, as a carrier for the PSAs. Water is preferably used as an emulsion when used as a carrier for acrylic PSAs. It may additionally be a carrier or a solvent for other components. When present the water will typically be present in
25 amounts ranging from 30% to 98%, preferably from 50% to 95% by weight.

Solvent/Carrier

30 Compositions of the present invention can also include solvents, as a carrier or solvent for the acrylic PSAs and other components. When present the solvent will

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typically be present in amounts ranging from 30% to 98%, preferably from 50% to 95% by weight. Examples of solvents are hydrocarbons, esters, alcohols etc. Particularly preferred solvents include ethyl acetate and isopropanol.

5 **Emollients**

Emollients such as hydrocarbons, esters, silicone fluids, may be included in the compositions of the invention. Emollients may typically be present in compositions of the invention in amounts of from 0.001% to 10% by weight, preferably 0.1% to 3% by weight. Emollients may be single compounds or mixtures of two or more compounds from the same class or different general classes.

Emollients may be included in any of the compositions of the invention, regardless of whether they contain a hair styling polymer. In one embodiment of the invention, the compositions (such as aerosol mousse formulations, for example) comprise a hair conditioning agent and are substantially free of hair styling polymer.

Suitable hydrocarbons can be either straight or branched chain and can contain from about 10 to about 16, preferably from about 12 to about 16 carbon atoms. Examples of suitable hydrocarbons are decane, dodecane, tetradecane, tridecane, and mixtures thereof.

Suitable oily or fatty materials are selected from hydrocarbon oils, fatty esters and mixtures thereof.

Straight chain hydrocarbon oils will preferably contain from about 12 to about 30 carbon atoms. Also suitable are polymeric hydrocarbons of alkenyl monomers, such as C₂-C₆ alkenyl monomers.

- 5 -

Specific examples of suitable hydrocarbon oils include paraffin oil, mineral oil, saturated and unsaturated dodecane, saturated and unsaturated tridecane, saturated and unsaturated tetradecane, saturated and unsaturated pentadecane, saturated and unsaturated hexadecane, and mixtures thereof. Branched-chain
5 isomers of these compounds, as well as of higher chain length hydrocarbons, can also be used.

Suitable fatty esters are characterised by having at least 10 carbon atoms, and include esters with hydrocarbyl chains derived from fatty acids or alcohols,
10 Monocarboxylic acid esters include esters of alcohols and/or acids of the formula $R'COOR$ in which R' and R independently denote alkyl or alkenyl radicals and the sum of carbon atoms in R' and R is at least 10, preferably at least 20. Di- and trialkyl and alkenyl esters of carboxylic acids can also be used.

15 Particularly preferred fatty esters are mono-, di- and triglycerides, more specifically the mono-, di-, and tri-esters of glycerol and long chain carboxylic acids such as C_1 - C_{22} carboxylic acids. Preferred materials include cocoa butter, palm stearin, sunflower oil, soyabean oil and coconut oil.

20 The oily/fatty material is suitably present at a level of from 0.05 to 10, preferably from 0.2 to 5, more preferably from about 0.5 to 3 wt%.

Examples of suitable silicone based emollients useful herein can include either cyclic or linear polydimethylsiloxanes, phenyl and alkyl phenyl silicones, and
25 silicone copolyols. Cationic conditioning agents useful herein can include quaternary ammonium salts or the salts of fatty amines, such as cetyl ammonium chloride, for example.

Compositions according to the invention may, optionally, comprise from 0.1% to
30 10% by weight of a volatile silicone as the hair conditioning agent. Volatile

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silicones are well known in the art and are commercially available and include, for example linear and cyclic compounds. Volatile silicone oils are preferably linear or cyclic polydimethylsiloxanes containing from about three to about nine silicon atoms.

5

The compositions of the invention may optionally comprise a cross-linked silicone polymer.

10 The cross-linked silicone polymer is preferably a non-rigid emulsion-polymerised and may be present in compositions of the invention in an amount of up to 10% by weight based on the total weight of the composition, more preferably from 0.2% to 6% by weight, most preferably from 0.5 to 5% by weight.

15 Preferred silicone polymers for use in the invention are polydiorganosiloxanes, preferably derived from suitable combinations of $R_3SiO_{0.5}$ units and R_2SiO units where each R independently represents an alkyl, alkenyl (e.g., vinyl), alkaryl, aralkyl, or aryl (e.g. phenyl) group. R is most preferably methyl.

20 The preferred silicone polymers of the invention are cross-linked polydimethyl siloxanes (which have the CTFA designation dimethicone), and cross-linked polydimethyl siloxanes having end groups such as hydroxyl (which have the CTFA designation dimethiconol). Good results have been obtained with cross-linked dimethiconol.

25 Cross-linking of the silicone polymer is typically introduced concurrently during emulsion polymerisation of the polymer through the inclusion of the required amount of trifunctional and tetrafunctional silane monomer units, for example, those of formula:

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R Si (OH)₃ wherein R represents an alkyl, alkenyl (e.g. vinyl), alkaryl, aralkyl or aryl (e.g. phenyl) group, preferably methyl.

The degree of cross-linking of the silicone polymer can be measured as the
5 percentage of branched monomer units in the silicone polymer and is from 0.05% to 10%, preferably being in the range 0.15% to 7%, e.g. from 0.2% to 2%.
Increasing cross-linking is found to improve styling benefits but also to reduce conditioning performance somewhat, so compromise levels must be selected with properties optimised to suit consumer preferences in different cases. Good
10 overall performance has been obtained with dimethiconol 0.3% cross-linked.

Suitable emulsion polymerised cross-linked silicone polymers are commercially available or can be readily made using conventional techniques well known to those skilled in the art.

15 Cross-linked silicone polymers are described in EP 818190, the contents of which are incorporated herein by reference.

Cationic Conditioning Agents

20 The compositions of the invention may optionally comprise cationic conditioning agents, in particular cationic surfactants, used singly or in admixture.

Cationic surfactants useful in compositions of the invention contain amino or
25 quaternary ammonium hydrophilic moieties, which are positively charged when, dissolved in the aqueous composition of the present invention.

Examples of suitable cationic surfactants are those corresponding to the formula:

30 $[N(R_1)(R_2)(R_3)(R_4)]^+ (X)^-$

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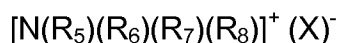
in which R₁, R₂, R₃, and R₄ are independently selected from (a) an aliphatic group of from 1 to 22 carbon atoms, or (b) an aromatic, alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alkylaryl group having up to 22 carbon atoms; and X is a salt-forming anion such as those selected from halogen, (e.g. chloride, bromide),
5 acetate, citrate, lactate, glycolate, phosphate nitrate, sulphate, and alkylsulphate radicals.

The aliphatic groups can contain, in addition to carbon and hydrogen atoms, ether linkages, and other groups such as amino groups. The longer chain aliphatic
10 groups, e.g., those of about 12 carbons, or higher, can be saturated or unsaturated.

The most preferred cationic surfactants for conditioner compositions of the present invention are monoalkyl quaternary ammonium compounds in which the alkyl chain length is C8 to C14.

15

Suitable examples of such materials correspond to the formula:



20 in which R₅ is a hydrocarbyl chain having 8 to 14 carbon atoms or a functionalized hydrocarbyl chain with 8 to 14 carbon atoms and containing ether, ester, amido or amino moieties present as substituents or as linkages in the radical chain, and R₆, R₇ and R₈ are independently selected from (a) hydrocarbyl chains of from 1 to about 4 carbon atoms, or (b) functionalized hydrocarbyl chains having from 1 to about 4
25 carbon atoms and containing one or more aromatic, ether, ester, amido or amino moieties present as substituents or as linkages in the radical chain, and X is a salt-forming anion such as those selected from halogen, (e.g. chloride, bromide), acetate, citrate, lactate, glycolate, phosphate nitrate, sulphate, and alkylsulphate radicals.

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The functionalised hydrocarbyl chains (b) may suitably contain one or more hydrophilic moieties selected from alkoxy (preferably C₁-C₃ alkoxy), polyoxyalkylene (preferably C₁-C₃ polyoxyalkylene), alkylamido, hydroxyalkyl, alkylester, and combinations thereof.

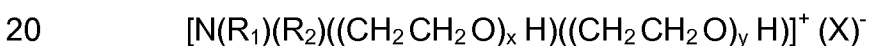
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Preferably the hydrocarbyl chains R₁ have 12 to 14 carbon atoms, most preferably 12 carbon atoms. They may be derived from source oils which contain substantial amounts of fatty acids having the desired hydrocarbyl chain length. For example, the fatty acids from palm kernel oil or coconut oil can be used as a source of C₈ to C₁₂ hydrocarbyl chains.

10

Typical monoalkyl quaternary ammonium compounds of the above general formula for use in shampoo compositions of the invention include:

- 15 (i) lauryl trimethylammonium chloride (available commercially as Arquad C35 ex-Akzo); cocodimethyl benzyl ammonium chloride (available commercially as Arquad DMCB-80 ex-Akzo)
- (ii) compounds of the formula:



wherein:

x + y is an integer from 2 to 20;

25

R₁ is a hydrocarbyl chain having 8 to 14, preferably 12 to 14, most preferably 12 carbon atoms or a functionalised hydrocarbyl chain with 8 to 14, preferably 12 to 14, most preferably 12 carbon atoms and containing ether, ester, amido or amino moieties present as substituents or as linkages in the radical chain;

30

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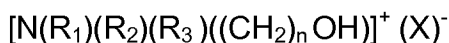
R₂ is a C₁-C₃ alkyl group or benzyl group, preferably methyl, and

X is a salt-forming anion such as those selected from halogen, (e.g. chloride, bromide), acetate, citrate, lactate, glycolate, phosphate nitrate, sulphate,
5 methosulphate and alkylsulphate radicals.

Suitable examples are PEG-n lauryl ammonium chlorides (where n is the PEG chain length), such as PEG-2 cocomonium chloride (available commercially as Ethoquad C12 ex-Akzo Nobel); PEG-2 cocobenzyl ammonium chloride (available
10 commercially as Ethoquad CB/12 ex-Akzo Nobel); PEG-5 cocomonium methosulphate (available commercially as Rewoquat CPEM ex-Rewo); PEG-15 cocomonium chloride (available commercially as Ethoquad C/25 ex-Akzo)

(iii) compounds of the formula:

15



wherein:

20 n is an integer from 1 to 4, preferably 2;

R₁ is a hydrocarbyl chain having 8 to 14, preferably 12 to 14, most preferably 12 carbon atoms;

25 R₂ and R₃ are independently selected from C₁ - C₃ alkyl groups, and are preferably methyl, and

X⁻ is a salt-forming anion such as those selected from halogen, (e.g. chloride, bromide), acetate, citrate, lactate, glycolate, phosphate nitrate, sulphate, and
30 alkylsulphate radicals.

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Suitable examples are lauryldimethylhydroxyethylammonium chloride (available commercially as Prapagen HY ex-Clariant).

Mixtures of any of the foregoing cationic surfactants compounds may also be
5 suitable.

Examples of suitable cationic surfactants include:

quaternary ammonium chlorides, e.g. alkyltrimethylammonium chlorides wherein
10 the alkyl group has from about 8 to 22 carbon atoms, for example
octyltrimethylammonium chloride, dodecyltrimethylammonium chloride,
hexadecyltrimethylammonium chloride, cetyltrimethylammonium chloride,
octyldimethylbenzylammonium chloride, decyldimethylbenzylammonium chloride,
stearyldi-methylbenzylammonium chloride, didodecyldimethylammonium chloride,
15 dioctadecyldimethylammonium chloride, tallow trimethylammonium chloride,
cocotrimethylammonium chloride, and the corresponding salts thereof, e.g.,
bromides, hydroxides. Cetylpyridinium chloride or salts thereof, e.g., chloride
Quaternium -5
Quaternium -31
20 Quaternium -18
and mixtures thereof.

In the conditioners of the invention, the level of cationic surfactant is preferably from
0.01 to 10, more preferably 0.05 to 5, most preferably 0.1 to 2 wt% of the total
25 composition.

Product Form

Compositions of the present invention are formulated into hair styling
30 compositions which may take a variety of forms, including, for example, mousses,

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gels, lotions, creams, sprays and tonics. These product forms are well known in the art.

The preferred product is a cream, spray, aerosol mousse or gel.

5

Aerosol-form compositions of the invention will include an aerosol propellant which serves to expel the other materials from the container, and forms the mousse character in mousse compositions. The aerosol propellant included in styling compositions of the present invention can be any liquefiable gas

10 conventionally used for aerosol containers. Examples of suitable propellants include dimethyl ether and hydrocarbon propellants such as propane, n-butane and iso-butane. The propellants may be used singly or admixed. Water insoluble propellants, especially hydrocarbons, are preferred because they form emulsion droplets on agitation and can create suitable mousse foam densities when
15 needed.

The amount of the propellant used is governed by normal factors well known in the aerosol art. For mousses the level of propellant is generally up to 35%, preferably from 2% to 30%, most preferably from 3% to 15% by weight based on
20 total weight of the composition. If a propellant such as dimethyl ether includes a vapour pressure suppressant (e.g. trichloroethane or dichloromethane), for weight percentage calculations, the amount of suppressant is included as part of the propellant. For aerosol sprays the levels of propellant are usually higher; preferably from 30 to 98 wt% of the total composition, more preferably 50 to 95 wt
25 % .

Preferred propellants are selected from propane, n-butane, isobutane, dimethyl ether and mixtures thereof. Preferably, the propellant comprises dimethyl ether and at least one of propane, n-butane and isobutane.

30

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The method of preparing aerosol hair styling mousse compositions according to the invention follows conventional aerosol filling procedures. The composition ingredients (not including the propellant) are charged into a suitable pressurisable container which is sealed and then charged with the propellant according to
5 conventional techniques.

Compositions of the invention may also take a non-foaming product form, such as a hair styling cream or gel. Such a cream or gel will include a structurant or thickener, typically at a level of from 0.1% to 10%, preferably 0.5% to 3% by
10 weight based on total weight.

Examples of suitable structurants or thickeners are polymeric thickeners such as carboxyvinyl polymers. A carboxyvinyl polymer is an interpolymer of a monomeric mixture comprising a monomeric olefinically unsaturated carboxylic acid, and from
15 about 0.01% to about 10% by weight of the total monomers of a polyether of a polyhydric alcohol. Carboxyvinyl polymers are substantially insoluble in liquid, volatile organic hydrocarbons and are dimensionally stable on exposure to air. Suitably the molecular weight of the carboxyvinyl polymer is at least 750,000, preferably at least 1,250,000, most preferably at least 3,000,000. Preferred
20 carboxyvinyl polymers are copolymers of acrylic acid cross-linked with allylsucrose or allylpentaerythritol as described in US Patent 2,798,053. These polymers are provided by B.F. Goodrich Company as, for example, CARBOPOL 934, 940, 941 and 980. Other materials that can also be used as structurants or thickeners include those that can impart a gel-like viscosity to the composition,
25 such as water soluble or colloiddally water soluble polymers like cellulose ethers (e.g. methylcellulose, hydroxyethylcellulose, hydroxypropylmethylcellulose and carboxymethylcellulose), guar gum, sodium alginate, gum arabic, xanthan gum, polyvinyl alcohol, polyvinyl pyrrolidone, hydroxypropyl guar gum, starch and starch derivatives, and other thickeners, viscosity modifiers, gelling agents, etc. It is also
30 possible to use inorganic thickeners such as bentonite or laponite clays.

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The hair styling compositions of the invention can contain a variety of non-essential, optional components suitable for rendering the compositions more aesthetically acceptable or to aid use, including discharge from the container, of the product. Such conventional optional ingredients are well known to those
5 skilled in the art, e.g. preservatives such as benzyl alcohol, methyl paraben, propyl paraben and imidazolidinyl urea, fatty alcohols such as cetearyl alcohol, cetyl alcohol and stearyl alcohol, pH adjusting agents such as citric acid, succinic acid, sodium hydroxide and triethanolamine, colouring agents such as any of the FD&C or D&C dyes, perfume oils, chelating agents such as ethylenediamine
10 tetraacetic acid, and polymer plasticising agents such as glycerin and propylene glycol.

The invention will now be further illustrated by the following, non-limiting Examples.

15

EXAMPLE 1

The following are formulations according to embodiments of the invention. They are made by the following process.

20

1. Weight 80% of the water and add EDTA and Natrosol into the main beaker under mixing
2. Heat to 75°C - solution will go clear
3. Cool down to 55C and add a premix of Durable Styling Complex (DSL) and
25 Water
4. Cool down to 40C and add the divinyl dimethicone / dimethicone
5. Add the mix Glycerin/Polyox
6. Add protein.
7. Add mix of perfume
- 30 8. Add preservatives

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9. Bring pH of batch up to ~pH 8

10. Discharge batch.

Appearance: creamy, thick milky liquid

pH 7.61

5

Ingredient	% wt.	A	B	C
	1	A	B	C
Hydroxyethylcellulose	0.75	0.75	0.75	0.75
Divinyldimethicone / Dimethicone Copolymer (and) C12-13 Pareth-23 (and) C12-13 Pareth-3	2.4	2.4	2.4	2.4
Glycerin	4	4	4	4
PEG-45M	0.02	0.02	0.02	0.02
EDTA	0.1	0.1	0.1	0.1
DMDM Hydantoin	0.22	0.22	0.22	0.22
PEG-40 Hydrogenated castor oil	0.5	0.5	0.5	0.5
Perfume	1	1	1	1
DSL	3	3	3	3
Keratin Protein Hydrolysate	0.4	0	0	0
Gliadin	0	0	0.4	0
Hydrolysed wheat protein copolymer	0	0	0	0.4
Water	To 100	To 100	To 100	To 100

EXAMPLE 2

10 The test formulations comprising various different proteins with the DSL were tested on subjects' heads. The subjects all had bleached hair.

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Four grams of test formulation as indicated in Example 1 were applied to each half head and the subjects asked to indicate which side was more easily combed when the test sample was rubbed into the hair.

Test	DSL + active	DSL
Keratin	10	2
Hydrolysed Wheat Protein	7	5
Gliadin	4	8
Hydrolysed (Hydrotritricum)	2	10

5

The results indicate that when keratin was applied with the DSL that the test formulation was more easily combed by the user. For other proteins this effect was not seen.

CLAIMS

1. Hair styling composition comprising a styling active comprising polyimide-1 and a polyvinylmethyl ether/maleic acid copolymer, and a scleroprotein.
5
2. Composition according to claim 1 wherein the styling active comprises a diol.
3. Composition according to claim 2, wherein the diol is selected from an
10 alkanediol having 4 to 16 carbon atoms, preferably 6 to 10 carbon atoms, preferably 6 to 8 carbon atoms, in the alkylene chain.
4. Composition according to claim 3, wherein the diol is selected from
15 butanediol, pentanediol, hexanediol, heptanediol, octanediol or decanediol, preferably 1,2-butanediol, 1,2-pentanediol, 1,2-hexanediol, 1,2-heptanediol, 1,2-octanediol.
5. Composition according to any preceding claim wherein styling active is
20 polyimide-1 and polyvinylmethyl ether/maleic acid copolymer and caprylyl glycol.
6. Composition according to claim 1 wherein the scleroprotein is selected from keratin, collagen, elastin and fibroin.
- 25 7. Composition according to any preceding claim wherein the styling active is present at from 0.01 to 5% wt. of the composition.
8. Composition according to any preceding claim wherein the scleroprotein is present at from 0.01 to 5% wt. of the composition.