

COSMETIC COMPOSITIONS FOR PROTECTION AGAINST AIR POLLUTANTS

Technical field of invention

The present invention relates to cosmetic compositions comprising an oak extract, a grape seed extract and a green tea extract which are useful to protect against air pollutants.

State of the art

5 It has long been known that air pollution has a significant impact on human health, and a number of specific warnings to that effect have recently been issued by the authorities. For example, in 2014 the US Environmental Protection Agency reported that over 142 million Americans live in areas wherein the air quality does not meet the National Ambient Air Quality Standards (<https://www.epa.gov/air-trends>).

10 In the same year, the WHO attributed 7 million premature deaths to air pollution exposure (<http://who.int/mediacentre/news/releases/2014/air-pollution/en/>), and there is increasing evidence that air pollutants have a damaging effect on the internal organs (*Curr. Vasc. Pharmacol.*, 2006, 4, 199-203).

In addition to the internal organs, among which the respiratory tract is obviously the
15 main target for air pollutants (*Annu. Rev. Public Health*, 1994, 15, 107-132), the skin is one of the most exposed target organs, due to its large surface and continual exposure.

To date, the environmental impact on skin health has mainly been evaluated in terms of the effect on the skin of ultraviolet radiation from sunlight (*J. Invest. Dermatol.*, 2003, 120, 1087-1093; *Prog. Biophys. Mol. Biol.*, 2006, 92, 119-131); however, in addition to
20 UV radiation, pollution also includes organic and inorganic substances which can potentially involve a further risk to skin health.

Among the environmental pollutants, various chemical classes have been identified, ranging from gaseous pollutants such as NO, CO and SO₂ and volatile organic compounds (VOC) to persistent organic pollutants (including pesticides and dioxin-like compounds).

25 Moreover, particulate matter (a complex mixture of drops of liquids and/or solids

in suspension in gas, while heavy metals like cadmium, lead, chromium and mercury are common air pollutants) is a source of health risk due to bioaccumulation, as it is typically absorbed by carbon particles suspended in the air, and can penetrate the skin and be accumulated (*Environ. Pollut.* 2008 151, 362-367).

5 In the absence of explanations of the overall mechanism whereby environmental pollutants can damage the skin, some mechanisms have been identified as the primary cause of skin damage on the basis of the currently available data. Said mechanisms, which mainly relate to heavy metals, include:

- generating free radicals (*J. Toxicol. Cut & Ocular Toxicol.*, 1987, 6(3), 183-191);
- 10 - inducing the inflammatory cascade (powders containing heavy metals have been found to increase gene expression of pro-inflammatory cytokines) (*Toxicol. Lett.*, 1999, 105, 92-99);
- reducing the natural defence mechanisms.

The external tissues of the skin are those most exposed to air pollutants, which
15 (especially heavy metals) reduce the cell defences against free radicals. Heavy metals therefore exacerbate the toxic effects of all the other gaseous pollutants, because they reduce the efficacy of the natural defence mechanisms and accelerate skin aging.

It has been demonstrated that these events leads, in particular, to accelerated extrinsic skin aging (with an increase in the formation of wrinkles and dark patches) (*Biol. Chem.*, 2010, 391, 1235-1248; *J. Investig. Dermatol.* 2010, 130, 2719-2726) and an
20 increase in atopic dermatitis (*Allergy*, 1996, 51, 532-539).

Although further extensive research is required to fully understand the mechanisms whereby air pollutants exert harmful effects on the skin, it should be noted that, in view of the limited scientific evidence, there are no guidelines designed to protect the scalp and hair
25 from air pollution, apart from limiting exposure thereto (*JEADV*, 2015, 29, 2326-2332).

In view of the factors set out above, there is still a need to found cosmetic compositions that effectively protect the skin, scalp, hair and external mucosa in particular against air pollutants.

Summary of the invention

The present invention relates to cosmetic compositions comprising an oak extract, a grape seed extract and a green tea extract which are useful to protect the skin, scalp, hair and external mucosa against air pollutants.

5 **Description of the invention**

The present invention relates to the use of cosmetic compositions comprising an oak extract, a grape seed extract and a green tea extract which are useful to protect the skin, scalp, hair and external mucosa against air pollutants.

According to a preferred embodiment, the compositions according to the invention
10 are useful to protect the external mucosa, especially that of the nose and mouth (such as the lips).

The oak extract (Q) is preferably an extract characterised by a total polyphenol content ranging between 30% and 60% w/w, more preferably equal to or greater than 45% w/w. The oak extract (Q) is preferably an aqueous dry extract.

15 According to a preferred embodiment, the oak extract can be obtained from bark.

The oak extract may be present in the composition in amounts ranging from 0.01% to 5% w/w, preferably from 0.05% to 1% w/w, more preferably amounts to 0.25% w/w, and even more preferably is 0.1% w/w.

The grape seed (GS) extract is preferably an extract characterised by a total
20 proanthocyanidin content (calculated by the Folin method and expressed as catechins) equal to or greater than 95% w/w and a monomer content (resulting from the sum of catechin and epicatechin expressed as catechin) ranging between 5 and 15% w/w evaluated by the HPLC method, and is more preferably an aqueous dry extract.

The grape seed extract may be present in the composition in amounts ranging from
25 0.01% to 5% w/w, preferably from 0.05% to 1% w/w, more preferably amounts to 0.25% w/w, and even more preferably is 0.1% w/w.

The green tea (GT) extract is preferably an extract characterised by a polyphenol content (calculated by the Folin method and expressed as catechins) equal to or greater than

40% w/w, and a catechin content (expressed as epicatechin-3-O-gallate), evaluated by the HPLC method, equal to or greater than 15% w/w, and is more preferably an aqueous dry extract.

According to a preferred embodiment, the green tea extract can be obtained from
5 the leaves.

The green tea extract may be present in the composition in amounts ranging from 0.01% to 5% w/w, preferably from 0.05% to 1% w/w, more preferably amounts to 0.25% w/w, and even more preferably is 0.1% w/w.

All the extracts are commercially available or can be easily prepared by the skilled
10 person using known techniques.

The compositions may preferably be administered topically.

Formulations comprising the compositions according to the invention can be obtained by conventional techniques as described, for example, in "Remington's Pharmaceutical Handbook", Mack Publishing Co., N.Y., USA.

15 Examples of topical formulations are emulsions, gels, foundations, lipsticks and ointments.

It has now surprisingly been found that compositions containing an oak extract, a grape seed extract and a green tea extract show a protection activity on the skin, scalp, hair and external mucosa against air pollutants greater than that obtainable when the extracts
20 are used separately, thus demonstrating a synergic activity. This is supported by the results of the experimental studies conducted.

In particular, the compositions according to the invention have proved useful in reducing the harmful effects induced by heavy metals as air pollutants.

The examples below further illustrate the invention.

Examples**Formulation example 1**

Ingredients (Tradename)	INCI name	%
Demineralised water	Aqua (Water)	65.450
Acemulgor A	Cetyl Alcohol, C12-20 Acid PEG-8 Ester	14.000
Nexbase 2006	Hydrogenated polydecene	6.000
Syntewax MS 2000	PEG-90 Stearate, Glyceryl stearate	4.500
Myritol 318	Caprylic/capric Triglyceride	4.000
Glycerin	Glycerin	3.000
Grape seed extract GS		0.250
Oak extract Q		0.250
Green tea extract GT		0.250
ABIL 350	Dimethicone	1.000
Phenoxyethanol	Phenoxyethanol	0.600
Polysorbate 60	Polysorbate-60	0.250
Bioscontrol Element	Imidazolidinyl urea	0.300
Disodium EDTA	Disodium EDTA	0.100
Aperoxid TLA	Lecithin, Tocopherol, Ascorbyl palmitate, Citric acid	0.050

The experiments conducted to evaluate the protective efficacy of the cosmetic composition of Example 1 and of the extracts used individually, in amounts equal to that present in the composition, are described below.

Example 2 - Evaluation of efficacy on cell viability

The experimental model used in this test is represented by human skin-derived fibroblasts (ATCC-CRL-2703). The cells were cultured in complete DMEM medium with 10% fetal bovine serum and maintained in an incubator at 37°C, 5% CO₂. The cells were grown to confluence for carrying out the tests. For carrying out the tests, human fibroblast cultures were treated for 24 hours with a mixture of heavy metals (Pb-Ef-Cr, each metal 90 µM), which are known pollutants typically present under air-dispersed pollution conditions. At the same time as the environmental damage, the cell cultures were treated with the test

products at 3 concentrations, selected among those which did not prove cytotoxic on the preliminary cytotoxicity test.

The cell cultures were exposed to the samples for 48 hours. At the end of the test period, cell viability was evaluated by MTT assay. The MTT assay (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) is a simple, accurate, standard colorimetric method for measurement of cell viability. The assay is based on intracellular reduction of yellow tetrazolium salts by the mitochondrial enzyme succinate dehydrogenase to blue/purple formazan crystals. The reaction can therefore only take place in metabolically active cells, and the optical density value obtained from a spectrophotometric reading can be correlated with the quantity of viable cells present. At the end of each treatment, all wells were washed with PBS, stained with an 0.5 mg/mL MTT solution and incubated for three hours in an atmosphere at 36.5°C/5% CO₂. The wells were then treated with isopropanol and incubated for two hours at room temperature. After incubation the absorbance readings were taken at 570 nm in the microplate reader (the isopropanol solution being used as blank). For each experimental condition, the ratio between the mean optical density of the treated cultures and the mean optical density of the negative controls determines the cell viability rate.

The results were compared with the negative control cultures (untreated, CTR-) and the positive control cultures (treated with heavy metals only, CTR+). The treatments were conducted in triplicate.

The table below (Table 1) shows the results expressed as protein content and as % protection compared with the positive control. The statistically significant t-test values are indicated by (*) for $p < 0.05$ and (**) for $p < 0.01$.

Table 1

	% cell viability	% protection vs CTR(+)
CTR(-)	100	-
CTR(+)	55.9	-
GS 0.001%	61.18	11.97*
GS 0.005%	68.90	29.4*
Q 0.001%	57.02	2.54
Q 0.005%	61.62	12.97*
TV 0.001%	60.18	9.70
TV 0.005%	65.5	21.7*
GS 0.001% + Q 0.001% + TV 0.001%	78.9	52.15**
GS 0.005% + Q 0.005% + TV 0.005%	97.5	94.33**

Example 3 - Evaluation of efficacy on cell metabolism (protein content)

The experimental model used in this test is represented by human skin-derived fibroblasts (ATCC-CRL-2703). The cells were cultured in complete DMEM medium with 10% fetal bovine serum and maintained in an incubator at 37°C, 5% CO₂. The cells were grown to confluence for carrying out the tests. For carrying out the tests, human fibroblast cultures were treated for 24 hours with a mixture of heavy metals (Pb-Ef-Cr, each metal 90 µM), which are known pollutants typically present under air-dispersed pollution conditions. At the same time as the environmental damage, the cell cultures were treated with the test products at 3 concentrations, selected among those which did not prove cytotoxic on the preliminary cytotoxicity test.

The cell cultures were exposed to the samples for 48 hours. At the end of the test period the cell metabolism was evaluated by assaying the protein content in the culture media.

Said evaluation was conducted by the Lowry colorimetric method on the cell culture media. The Lowry assay uses the same principle as the biuret method, i.e. the reaction whereby in an alkaline medium, Cu⁺ ions complex to the proteins and catalyze the oxidation process of tyrosine and tryptophan residues. Said oxidation generates reduction of the Folin-Ciocalteu reagent which, from the characteristic yellow colour, turns blue; the darker the blue colour, the more proteins are present in the biological matrix. The

quantitative determination uses a calibration curve constructed with increasing known concentrations of standard albumin.

The table below shows the results expressed as protein content and as % protection compared with the positive control. The statistically significant t-test values are indicated

5 by (*) for $p < 0.05$ and (**) for $p < 0.01$.

Table 2

	Protein content (μg)	% protection vs CTR(+)
CTR(-)	52.12 ± 2.21	-
CTR(+)	24.21 ± 1.98	-
GS 0.001%	27.30 ± 1.52	11.07
GS 0.005%	31.31 ± 1.78	25.43*
Q 0.001%	25.93 ± 2.01	6.16
Q 0.005%	27.90 ± 1.85	13.22*
TV 0.001%	26.93 ± 1.53	9.74
TV 0.005%	27.83 ± 1.63	12.97*
GS 0.001% + Q 0.001% + TV 0.001%	39.12 ± 2.21	53.42**
GS 0.005% + Q 0.005% + TV 0.005%	50.90 ± 2.05	95.62**

As clearly demonstrated by the examples above, the effect obtainable by administering the compositions according to the invention is greater than the sum of the individual effects obtainable by administering the oak, grape seed and optionally green tea
 10 extracts separately. In other words, the interaction between the individual active ingredients produces an evident synergic effect.

CLAIMS

1. Non-therapeutic use of cosmetic compositions comprising as active ingredients an oak extract, a grape seed extract and a green tea extract in the protection of skin,
5 scalp and nasal or oral mucosae from air pollutants, wherein the air pollutants are heavy metals.
2. Use according to claim 1, wherein the oral mucosae are lips.
- 10 3. Use according to claim 1 or 2, for topical administration.
4. Use according to claims 1-3, wherein the oak extract is characterised by a total polyphenol content ranging from 30% to 60% w/w, more preferably equal to or greater than 45% w/w.
- 15 5. Use according to claims 1-4, wherein the oak extract is present in amounts ranging from 0.01% to 5% w/w, preferably from 0.05% to 1% w/w, more preferably is equal to 0.25% w/w, and most preferably is equal to 0.1% w/w.
- 20 6. Use according to claims 1-5, wherein the grape seed extract is characterised by a total proanthocyanidin content calculated by the Folin method and expressed as catechins equal to or greater than 95% w/w, and a monomer content resulting from the sum of catechin and epicatechin expressed as catechin ranging from 5% to 15% w/w.
- 25 7. Use according to claims 1-6, wherein the grape seed extract is present in amounts ranging from 0.01% to 5% w/w, preferably from 0.05% to 1% w/w, more preferably is equal to 0.25% w/w, and most preferably is equal to 0.1% w/w.
- 30 8. Use according to claims 1-7, wherein the green tea extract is characterised by a polyphenol content calculated by the Folin method and expressed as catechins equal to or greater than 40% w/w and a catechin content expressed as epicatechin-3-O-gallate equal to or greater than 15% w/w.

9. Use according to claims 1-8, wherein the green tea extract is present in amounts ranging from 0.01% to 5% w/w, preferably from 0.05% to 1% w/w, more preferably is equal to 0.25% w/w, and most preferably is equal to 0.1% w/w.

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10. Use according to claims 1-9, wherein the extracts are aqueous dry extracts.