

PRODUCT, DESCRIPTION AND EVIDENCE

REFERENCE: FS7-21

PUBLISH DATE: 11/05/2023

ILLUMINATE

A lightweight, fragrance-free lotion specifically designed to target uneven skin tone. Containing Alpha Arbutin, Azelaic Acid, Kojic Acid and Diglycosyl Gallic Acid, to help reduce the signs of the melanin-promoting enzyme tyrosinase with antioxidant properties. This lotion will help reduce the appearance of unwanted uneven skin tones, improve skin texture, and lighten the skin's appearance. This lotion also contains powerful anti-ageing ingredients such as Oligopeptide-68, Acetyl Glucosamine and Tranexamic acid which help to stimulate the production of collagen, elastin, and hyaluronic acid to reduce the appearance of fine lines and wrinkles.

KEY BENEFITS:

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|--|--|
| Skin appears brighter and radiant | Improves skin complexion and evens skin tone |
| Skin feels firmer and tighter | Stimulates collagen production |
| Improves the signs of skin inflammation and redness | Reduces skin inflammation up to 51% |
| Can be used locally to target areas of concern or globally if required | Improves skin texture for smoother, younger feeling skin |
| Reduces tyrosinase activity by 60% | 150% reduction in global melanin content |
| 30% improvement in skin brightness | |

DIRECTIONS FOR USE

Night-time use only. Apply liberally to areas of concern. An SPF 50+ must be worn and applied regularly whilst using this product.

WARNINGS

For external use only. Avoid contact with eyes. If this occurs, wash affected area thoroughly with water. If irritation occurs, discontinue use. Store this product below 40°C.

INGREDIENTS

Aqua, Butylene Glycol, Propanediol, Glycerin, C15-19 Alkane, Alpha-Arbutin, Azelaic Acid, Tranexamic Acid, Kojic Acid, Coco-Caprylate/Caprates, Acetyl Glucosamine, Pullulan, Diglycosyl Gallic Acid, Silica, Tocopherol, Helianthus Annuus Seed Oil, Lecithin, Xanthan Gum, Sclerotium Gum, Glycine Soja Oil, Sodium Gluconate, Sodium Acrylates Copolymer, Hydrogenated Lecithin, Oligopeptide-68, Sodium Oleate, Phenoxyethanol, Benzoic Acid, Dehydroacetic Acid, Disodium EDTA.

ACTIVE INGREDIENTS

Oligopeptide-68 47.5mg*
Diglycosyl Gallic Acid 599mg *
Alpha Arbutin 2%
Azelaic Acid 2%
Kojic Acid 0.5%
Tranexamic Acid 1%
Tocopherol 3550mg*
Silica 300mg*

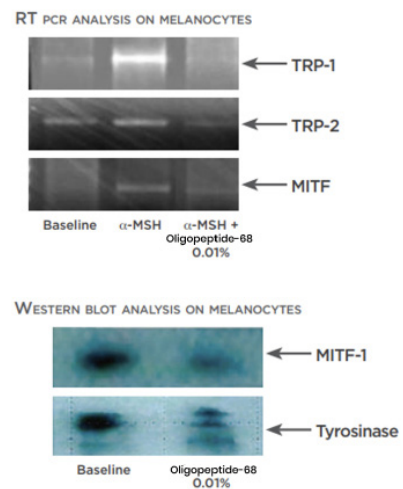
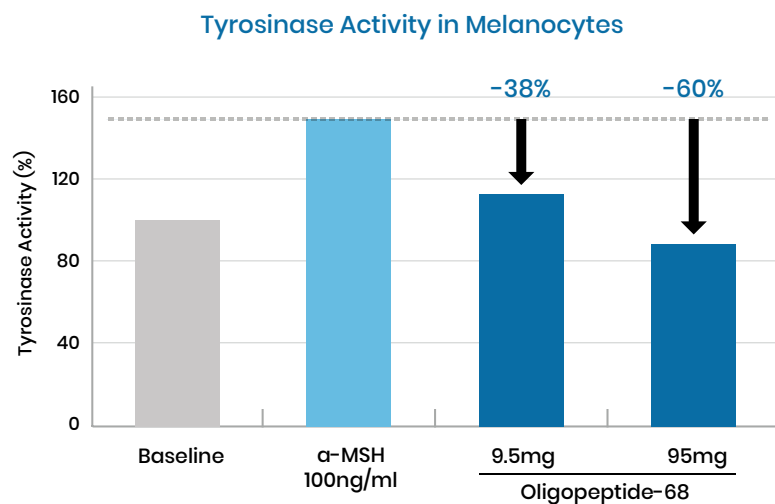
OLIGOPEPTIDE-68

| | |
|---|----------------------------------|
| Stimulates collagen production | Improves skin texture |
| Improves appearance of dark spots, age spots and evens complexion | Skin feels firmer and tighter |
| Reduces tyrosinase activity by 60% | Melanin synthesis reduced by 44% |
| 30% improvement in skin brightness | |

Oligopeptide-68 is a synthetic skin-brightening peptide that is derived from a protein called tyrosinase. It is a popular ingredient in skin care products due to its ability to reduce the appearance of hyperpigmentation, promote collagen production, and improve skin texture. When applied topically, Oligopeptide-68 has several benefits for the skin, such as:

- **Hyperpigmentation reduction:** Oligopeptide-68 is known for its ability to reduce the appearance of hyperpigmentation, such as dark spots, age spots, and melasma. It works by inhibiting the production of melanin, which is responsible for skin colour.
- **Collagen production:** Oligopeptide-68 has been shown to stimulate the production of collagen, which is essential for maintaining the skin's elasticity and firmness. This can help to reduce the appearance of fine lines and wrinkles.
- **Even skin tone:** By reducing hyperpigmentation, oligopeptide-68 can help to even out skin tone and create a more uniform complexion.
- **Anti-inflammatory properties:** Oligopeptide-68 has been shown to have anti-inflammatory properties, which can help to calm redness and irritation caused by conditions such as rosacea, acne, and eczema.

Inhibiting proteins involved in the pigmentation process



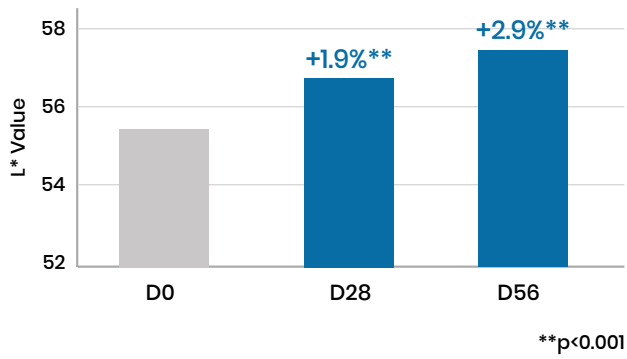
Increasing Skin Lightness

Test protocol:

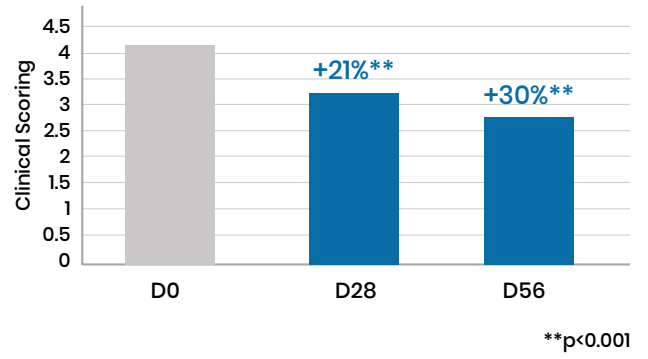
- 23 Asian volunteers presenting at least one hyper-pigmented spot (33 to 55 years old)
- Application of cream Oligopeptide-68 5%, x2 a day for 56 days.
- Colorimetric measurements: analysis of the colorimetric parameter (L^*) on the face.
- Clinical evaluation by dermatologists with a skin color scale at D0, D28 and D56



Skin Lightness (L*) Evaluation



Clinical Evaluation of Skin Colour



Consumer Evaluation at D56

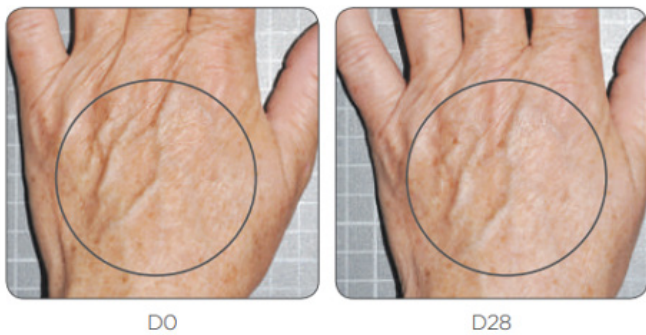


Oligopeptide-68 reduces the appearance of pigmented spots. 100% of the subjects demonstrated a significant increase in skin lightness.

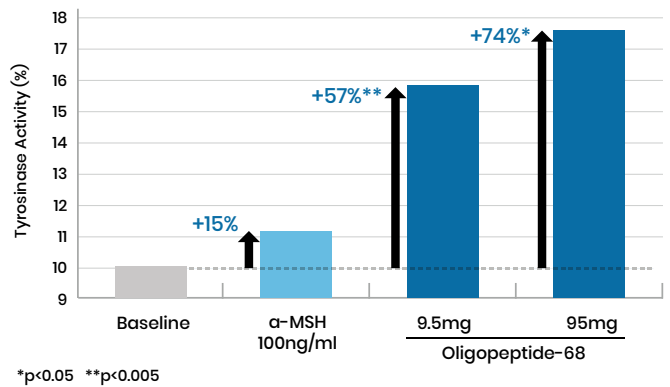
Reduction of colour intensity

Test protocol

19 women (51 to 69 years old) volunteers applied a product containing 2% Oligopeptide-68 and 1% Exo-T 2x/day on hands and décolleté.



Improvement of the hand spots pigmentation degree



Oligopeptide-68 induces skin lightening effect after only 2 weeks

Link: <https://pubmed.ncbi.nlm.nih.gov/26833454/>

ALPHA ARBUTIN

| | |
|---|---|
| Evens skin tone and improves the appearance of dark spots and age spots | Contains antioxidant properties that protect the skin from oxidative damage |
| Brightens complexion for a more radiant appearance | |

Alpha arbutin is a natural ingredient that is derived from the leaves of certain plants such as bearberry, cranberry, and blueberry. It is a form of hydroquinone that has been chemically modified to be more stable and effective in skin care products.

When applied to the skin, alpha arbutin has several benefits, including:

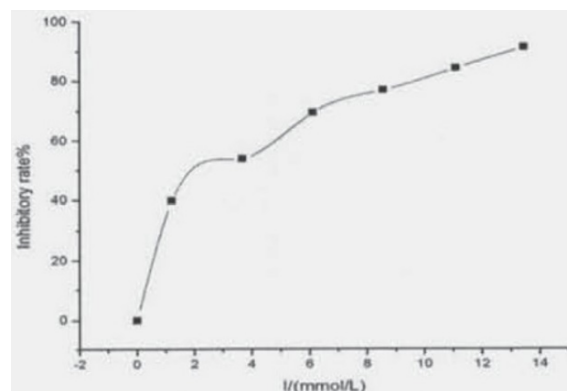
1. **Hyperpigmentation reduction:** Alpha Arbutin is known for its ability to reduce the appearance of hyperpigmentation, such as dark spots, age spots, and melasma. It works by inhibiting the activity of the enzyme tyrosinase which is involved in the production of melanin (responsible for skin colour).
2. **Even skin tone:** By reducing hyperpigmentation, alpha arbutin can help to even out skin tone and create a more uniform complexion.
3. **Anti-aging benefits:** Alpha arbutin has antioxidant properties that can help to protect the skin from free radical damage, which can lead to premature aging, including fine lines, wrinkles, and age spots.
4. **Brightening effect:** Alpha arbutin can give the skin a brighter, more radiant appearance by reducing the appearance of dull, sallow skin.
5. **Safe for all skin types:** Unlike some other skin lightening ingredients, such as hydroquinone, alpha arbutin is considered safe for all skin types, including sensitive skin.

Overall, alpha arbutin is a beneficial ingredient for those looking to improve the appearance of hyperpigmentation and achieve a brighter, more even skin tone.

Right: the curve of the inhibition rate of monophenolase of mushroom tyrosinase by α -arbutin

Links:

- <https://www.ncbi.nlm.nih.gov/pubmed/16233788>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2904932>
- <https://pubmed.ncbi.nlm.nih.gov/33724594/>
- <https://pubmed.ncbi.nlm.nih.gov/30032433/>
- <https://pubmed.ncbi.nlm.nih.gov/35054770/>



DIGLUCOSYL GALLIC ACID

| | |
|--|--------------------------------|
| 4X the antioxidant efficacy of vitamin C | Up to 94% photo protection |
| Reduces skin inflammation up to 51% | 7.5% improvement in UV spots |
| 150% reduction in global melanin content | 600% reduction in skin redness |
| Skin appears 11.5% brighter | |

Diglucoyl Gallic Acid is a natural compound derived from three Indian fruits: Amla, Haritaki, and Bibhitaki. When applied to the skin, it has several potential benefits, including:

- **Antioxidant:** Diglucoyl Gallic Acid is a potent antioxidant that can help to protect the skin from free radical damage caused by environmental factors such as UV radiation, pollution, and stress. This can help to prevent premature aging of the skin and maintain a youthful appearance.
- **Anti-inflammatory:** Diglucoyl Gallic Acid has anti-inflammatory properties that can help to reduce redness, swelling, and irritation of the skin. It can be particularly beneficial for people with sensitive or acne-prone skin.
- **Skin brightening:** Diglucoyl Gallic Acid can help to brighten the skin and improve its tone and texture. It works by inhibiting the production of melanin, which can help to reduce the appearance of dark spots, hyperpigmentation, and uneven skin tone.
- **Moisturising:** Diglucoyl Gallic Acid can help to moisturise the skin and improve its hydration levels. This can help

to prevent dryness, flakiness, and roughness of the skin, leaving it soft, smooth, and supple.

- Collagen production: Digluco-syl Gallic Acid can stimulate the production of collagen, a protein that gives the skin its structure and elasticity. This can help to improve the firmness and elasticity of the skin, reducing the appearance of fine lines and wrinkles.

Protective effect of Digluco-syl Gallic Acid (in vitro)

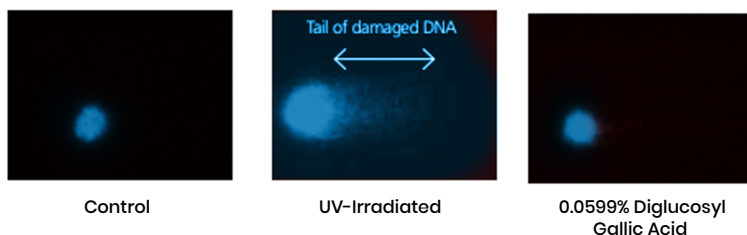
1. Antioxidant effect of Digluco-syl Gallic Acid.

THBG and its microbiote acitivated derivative THBA were evaluated to their antioxidant property using the DPPH assay. They were compared with vitamin C. The anti-radical activity of the compounds was expressed as a decrease of concentration of DPPH or as EC50 (concentration of a compound decreasing the absorbance of DPPH solution by 50%)

Results: Digluco-syl Gallic Acid has an instant antioxidant activity. This free radical scavenging activity is amplified by skin microbiote upon conversion of THBG into THBA showing a 4x better antioxidant efficacy compared to Vitamin C.

2. DNA protection by Digluco-syl Gallic Acid.

Digluco-syl Gallic Acid was tested for it's photo-protection activity using the Comet assay on melanocytes. This test measures the degradation of DNA in skin cells exposed to solar irradiation. Digluco-syl Gallic Acid has been tested at three concentrations: 0.00599%, 0.01198% and 0.0599%



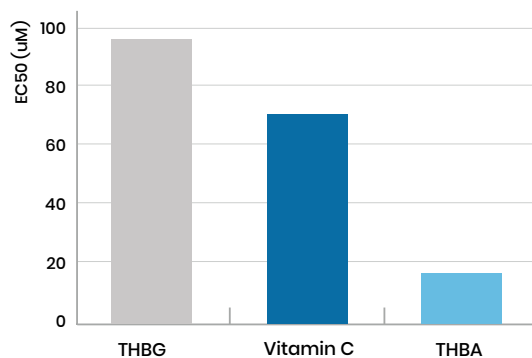
Results: Digluco-syl Gallic Acid shows and excellent DNA protection with up to 94% of photo-protection at 0.0599% Digluco-syl Gallic Acid

3. Control of skin inflammation

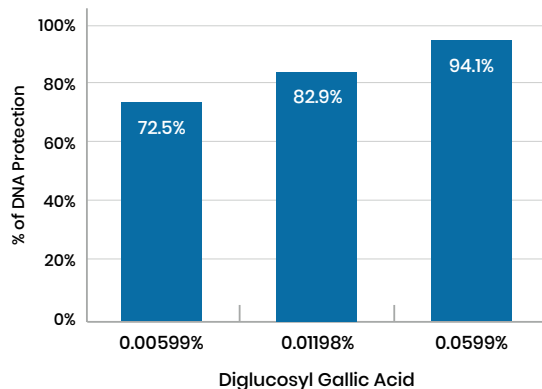
Digluco-syl Gallic Acid was tested for it's anti-inflammatory property. Human cells were stressed with IL-1 including a pro-inflammatory NF-kB repose. THBG was tested at 0.01198%, 0.02396%, 0.0599% and 0.1198% to evaluate its inhibition effect on the Nf-kB pathway.

Results: Digluco-syl Gallic Acid inhibits NF-kB response up to 90% at 0.1198%

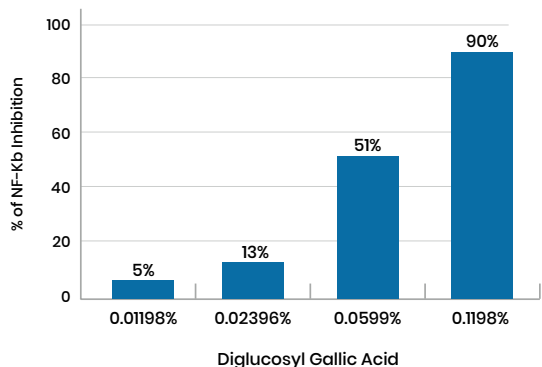
Antioxidant Properties



DNA Protection



NF-kB Inhibition



Digluco-syl Gallic Acid: Visible uniformity and brighter skin tone (clinical evaluation)

A double blind study versus a placebo under dermatological control was done on 20 Korean women aged between 30 and 60 years with dark spot on the face. The study started at the end of summer period which the UV exposure is still important. They were applied twice a day a placebo cream on one side of the face, and the same cream containing 0.0599% Digluco-syl Gallic Acid on the other side of the face for 84 days. Skin colour, brightness and redness were assessed using different equipments (Visia CR, Siascope and Chromameter).

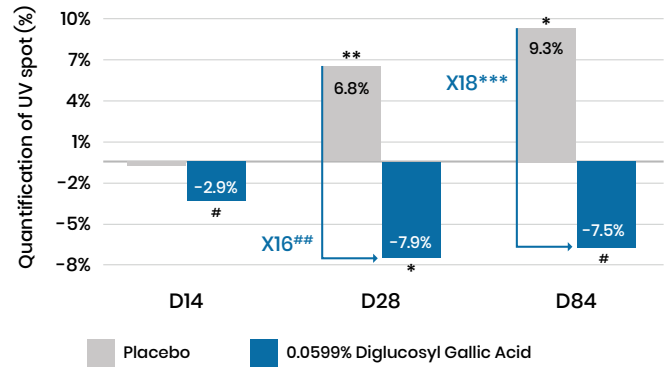
1. UV spots reduction (Visia CR) // Uniformization of skin tone.

UV spots happen when melanin coagulates below the skin surface because of sun exposure. They are a marker of photo damages. Reducing UV spots content enables to decrease the level of future hyperpigmented spots at the skin's surface.

Results: Diglucosyl Gallic Acid decreases UV spots in one month compared to placebo, with up to 18 times better results after 84 days.

p<0.1 compared to D0, Student's t-test
 * p<0.05 compared to D0, Student t-test
 ** p<0.01 compared to D0, Student t-test
 *** p<0.005 compared to D0, Student t-test

Photoprotection: rapid reduction of UV spot

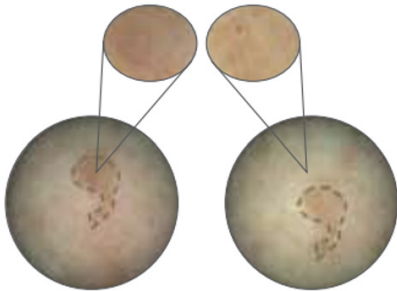


2. Improvement of skin lightening (Siascope)

Melanin content was measured with the Siascope on a spot area. The reduction of the melanin content was observed on the skin and on the pigmented spots.

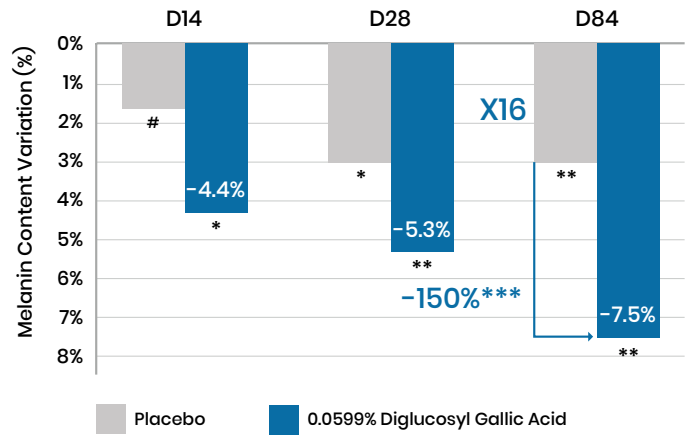
Results: Diglucosyl Gallic Acid decreases global melanin content by +150% compared to placebo, after 84 days.

Skin and hyperpigmented spots are visibly whiter.



p<0.1 compared to D0, Student's t-test
 * p<0.05 compared to D0, Student t-test
 ** p<0.01 compared to D0, Student t-test
 *** p<0.05 compared to placebo, Student t-test

Decrease of Melanin Content



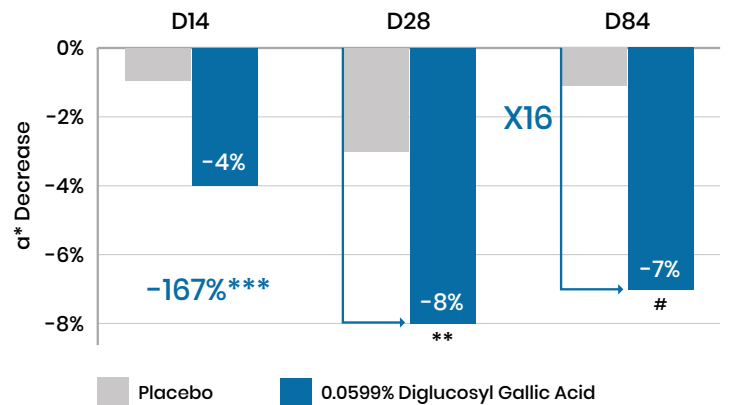
3. Decrease of skin redness (Chromameter)

The a* value corresponds to the red component of the skin. This value has been measured upon time and compared to the placebo data.

Results: Diglucosyl Gallic Acid decreases the skin a* value by -600% compared to placebo, after 84 days.

p<0.1 compared to D0, Student's t-test
 * p<0.01 compared to D0, Student t-test
 ** p<0.0001 compared to D0, Student t-test
 *** p<0.01 compared to D0, Student t-test

Redness Reduction



4. Increase of skin brightening (Chrometer)

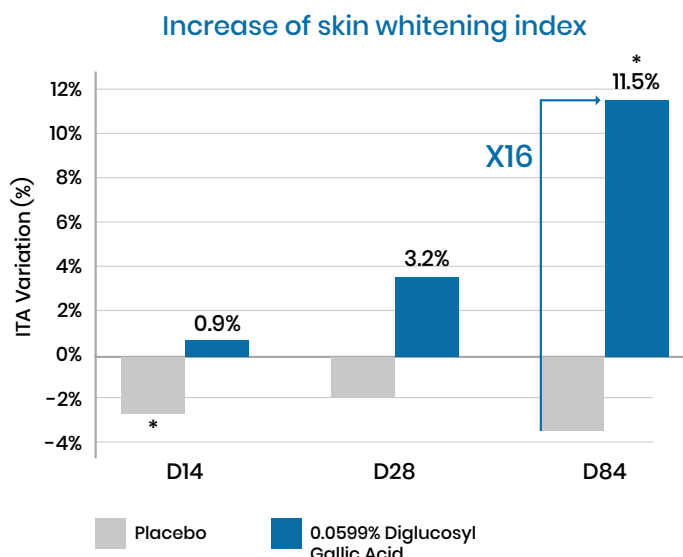
ITA angle is an essential parameter related with the global brightening efficacy of a product, which takes into account the L* and b* values. The more ITA is increased, the whiter the skin is.

Results: Diglucoyl Gallic Acid increases skin whitening index ITA by 16 times compared to placebo, after 84 days.

* p<0.05 compared to D0, Student t-test.



Digital pictures from Visia CR



Links:

- <https://pubmed.ncbi.nlm.nih.gov/35211990/>
- <https://pubmed.ncbi.nlm.nih.gov/31584241/>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3828909/>

AZELAIC ACID

| | |
|---|---|
| Regulates sebum production | Protects the skin from oxidative damage |
| Gently exfoliates the skin by removing dead skin cells | Soothes irritation |
| Inhibitory effect on tyrosinase activity to improve skin tone | Brightens skin complexion |
| Effective against blemishes and redness | |

Is naturally found in grains such as rye and barley. It can also be produced by a yeast that naturally lives on skin, known as *Malassezia furfur*. Unlike glycolic and lactic acid which are alpha hydroxy acids, azelaic acid is a dicarboxylic acid.

It can act as an exfoliating agent to remove dead skin cells and improve skin conditions related to breakouts and inflammation. Chemically, azelaic acid works on the skin as a gentle exfoliant, helping to unclog pores and refine the skin's surface for a more even complexion. Azelaic Acid also delivers antioxidant benefits. It has anti-inflammatory actions and soothes irritation and inflammation as well as a skin brightening effect and has been found to improve rosacea type skin conditions.

Azelaic Acid was found to have an effect in reducing the appearance of melasma and has been shown to have an inhibitory effect on tyrosinase activity and so being an effective ingredient in reducing melanin production and pigmentation.

Key Benefits

- Inhibit bacterial growth-anti-acne.
- Balance oil secretion.
- Inhibit melanin production.
- Inhibit inflammation.
- Anti-oxidation.
- Prevents skin hyperkeratosis.

- Works against acne-causing *Propionibacterium acnes* (*P. acnes*) - a great choice for acne-prone skin.
- Works on the cells that line hair follicles by changing the way they mature and proliferate, which decreases follicular 'plugging' & helps prevent blackheads and whiteheads.
- Has anti-keratinizing effect on normal skin & reduce the synthesis of filamentous keratin & prevents excessive keratinization of hair follicles.
- Inhibits the production of reactive oxygen free radicals and exerts anti-inflammatory effects.
- Inhibit tyrosinase activity and pigment synthesis in abnormal pigment cells & inhibits DNA synthesis and mitochondrial enzyme activity in abnormal pigment cells.
- Help reducing malignant cell proliferation activity & prevent malignant melanoma from developing in malignant freckles.
- Especially effective for post-inflammatory hyperpigmentation (that often comes with acne) and melasma (Not for lightening age spots that are called solar lentigines).

Acne Treatment

The physiological and pathological mechanisms of acne appear to depend on four major factors, namely:

1. Sebum production and excretion
2. Keratinisation of follicular pathways
3. Microbial colonization of pilosebaceous units per follicle
4. Inflammatory responses in the surrounding areas of hair follicles

- Azelaic acid is effective against acne because of its ability to combat all of activity listed previously.
- Azelaic acid is a competitive inhibitor of mitochondrial oxidoreductases and 5-a-reductase.
- Azelaic acid also has anti-bacterial properties against aerobic and anaerobic bacteria, including *Propionibacterium acnes*.
- Azelaic acid is an anti-keratinising agent, which can inhibit the proliferation of keratinocytes and modulation of the differentiation of epidermal cells.

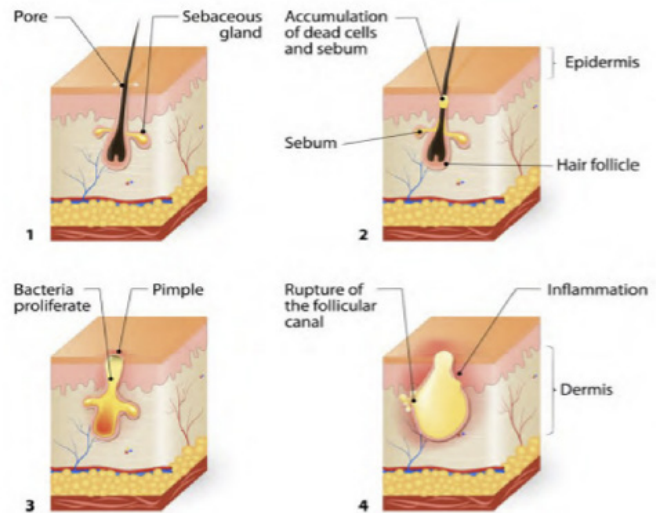


Diagram of acne formation

Skin Lightening

Results:

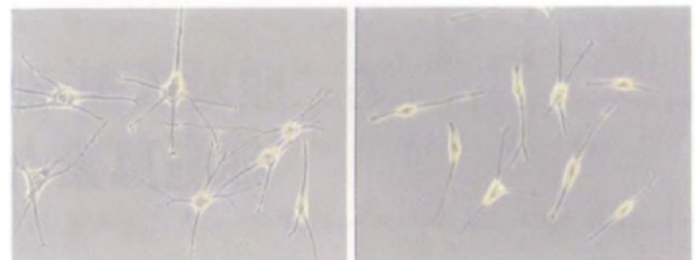
Compared with before staining, brown particles were deposited around the cell body after staining, but no obvious brown particles were seen in the dendrites.

After 72 hours of Azelaic Acid treatment of human epidermal MC, dendritic cells were reduced. Normal epidermal MC dendrites were mostly 3-5 poles, and as many as 10 poles.

After drug action, it can be seen that the dendrites of the cells are mostly reduced to 1-2 poles. In mouse melanoma B16 cells, 72 hours after Azelaic Acid treatment, there was no visible morphological change.

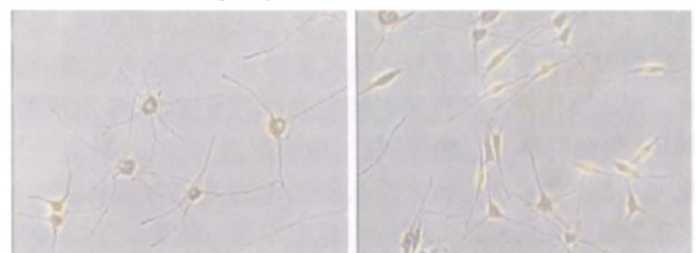
Right: A and B are the control group and the drug group before staining; C and D are the control group and the drug group after TRP-1 staining; A and C can be seen that the dendritic cells of normal cells are mostly 3-5 poles more. After reaching 10 poles, 72 hours after B and D azelaic acid treatment, the cell dendrites were mostly reduced to 2 poles

TRP 1 staining



A. blank control group

B. 0.5 mmol/L azelaic acid

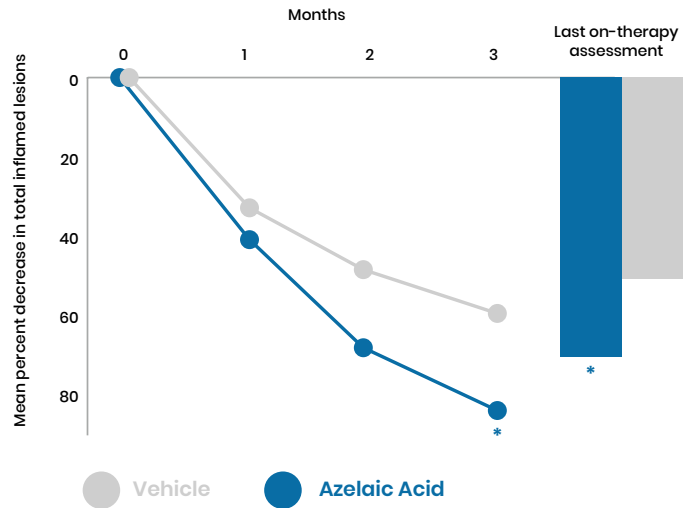


A. blank control group

B. 0.5 mmol/L azelaic acid

Treatment of Papulo-pustular Rosacea

Result: Azelaic acid cream produced significantly greater reductions than vehicle in total inflammatory lesion count. From baseline to the last on-therapy assessment, the mean decrease in the sum of papules and pustules was 73.4% in the azelaic acid group (mean count at baseline~30.8; last on-therapy count=8.3) compared with 50.6% (mean count at baseline=31.7; last on-therapy count=15.3) in the vehicle group (p=0.011). Treatment difference was also noted in the completed patients at the month 3 examination (p=0.012). With regard to the single type of inflammatory lesions between-group differences were evident for papules but not for pustules. A mean overall decrease in papules of 71.5%.



Links:

- <https://onlinelibrary.wiley.com/doi/abs/10.1111/jocd.12217>
- <https://pubmed.ncbi.nlm.nih.gov/26355614/>
- <https://pubmed.ncbi.nlm.nih.gov/2909138/>

KOJIC ACID

| | |
|--|-------------------------|
| Inhibits tyrosinase activity to improve the appearance of dark spots | Skin brightening effect |
| Improves skin tone | |

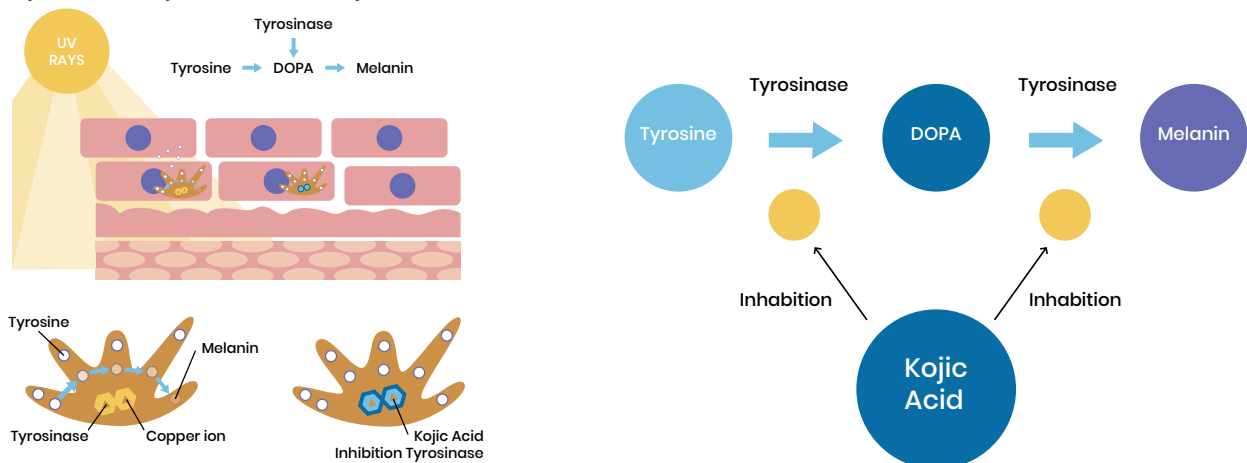
Kojic Acid was discovered in 1907 through isolation from the mycelia of *Aspergillus oryzae* grown on steamed rice (the term koji means steamed rice in Japanese). Kojic Acid is classified in the group of organic acids which is obtained from different types of fungi such as mushrooms and rice malt during the aerobic fermentation process.

Kojic Acid is a natural metabolite that has the ability to inhibit tyrosinase activity essential for the synthesis of melanin. In addition, Kojic acid has antioxidant anti-proliferative, anti-inflammatory properties. It is a popular skin care ingredient known for its ability to reduce the appearance of hyperpigmentation and improve skin tone.

Key Benefits:

- Tyrosinase inhibitor & Skin lightening agent.
- Ultra-violet filter & Radical scavenging activity.
- Helps collagen production.
- Treats skin disorders such as melasma and other related diseases.
- Acts as an antibiotic against human tubercle bacilli, gram-negative and grampositive microorganisms.
- Excellent antibacterial activity.

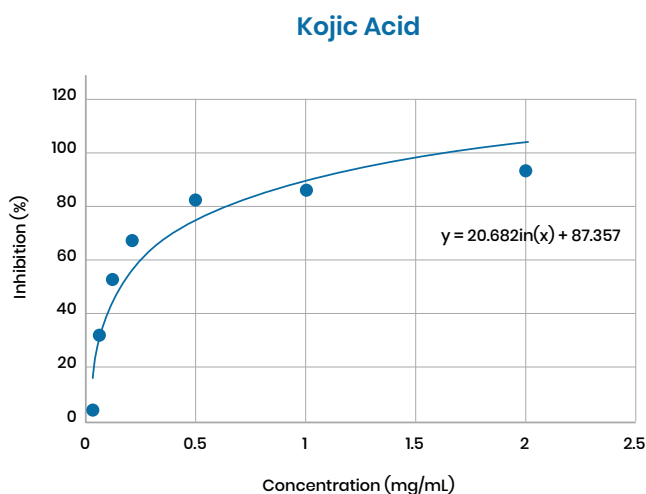
Inhibitory effect on tyrosinase activity:



Tyrosinase contain copper ion in the active site. When exposed to UV rays, the copper ion commands the tyrosinase to become more active.

Kojic Acid captures the copper ion, preventing that from activating the tyrosinase, Kojic Acid can also prevent creating melanin.

Kojic Acid has a strong inhibitory effect on tyrosinase activity. The inhibition rate of 2.0mg/ml. Kojic Acid on tyrosinase enzyme activity can reach 93%, and the IC50 value of Kojic Acid is calculated to 0.16mg/ml according to the dose response curve.



Patients showing improvements in Melasma during the study on the sides with or without Kojic Acid

| Improvement in melasma | With Kojic Acid | | | Without Kojic Acid | | |
|------------------------|-----------------|-----------|-----------|--------------------|-----------|-----------|
| | 4 Weeks | 8 Weeks | 12 Weeks | 4 Weeks | 8 Weeks | 12 Weeks |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 0-25% | 18 | 7 | 2 | 19 | 10 | 1 |
| 25-50% | 16 | 22 | 14 | 19 | 20 | 20 |
| 50-75% | 5 | 8 | 15 | 1 | 10 | 14 |
| 75-99% | 0 | 3 | 7 | 0 | 0 | 5 |
| Clear | 0 | 0 | 2 | 0 | 0 | 0 |
| Total | 40 | 40 | 40 | 40 | 40 | 40 |

Improvement was assessed as 0-25%, 25-50%, 50-75%, more than 75%, and clear, and given scored of +1, +2, +3, +4, and +5, respectively. All had malar melasma with 3 having melasma on the forehead and chin. They had their melasma for 2 to 10 years, the majority having the condition for more than 5 years.

All had previous treatments with Hydroquinone but not Kojic Acid or Glycolic Acid.

All had stopped treatments at least 4 weeks prior to the study. Sunlight aggravated melasma in all patients; 21 out of 40 (52.5%) had a family history of melasma.

- At the end of the study, all patients showed improvement in their melasma, regardless of whether Kojic acid was used or not.
- The overall reduction in melasma varied from 25% to 100% or from a score of +1 to +5.
- Only two patients had complete clearance of their melasma, and this was on the side where Kojic Acid was used.

Links:

<https://pubmed.ncbi.nlm.nih.gov/30537675/>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3468271/>

TRANEXAMIC ACID

| | |
|--|---|
| Evens skin tone and reduces appearance of dark spots | Improves skin texture and reduces skin inflammation |
| Calms irritated, red skin | Brightens skin complexion |

Tranexamic acid is a synthetic form of the amino acid lysine that has been used in medicine for decades to reduce bleeding. In recent years, it has gained popularity as a skin care ingredient for its ability to address hyperpigmentation, inflammation, and signs of aging.

Tranexamic acid has several skin benefits including:

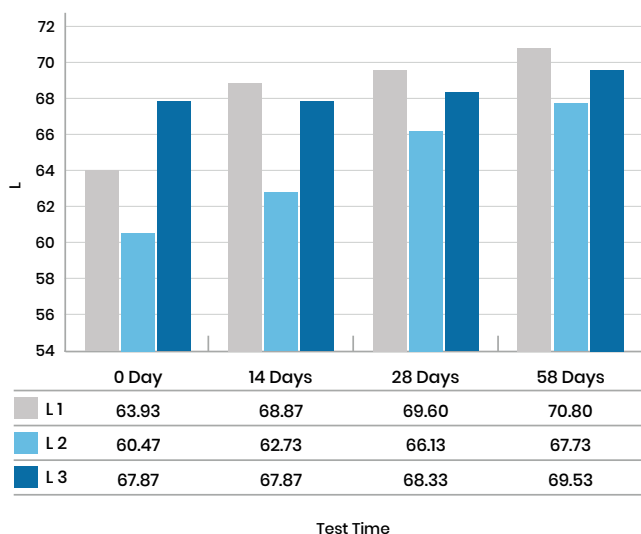
- **Hyperpigmentation reduction:** Tranexamic acid has been shown to reduce the appearance of dark spots and hyperpigmentation by inhibiting the production of melanin.
- **Anti-inflammatory properties:** Tranexamic acid has been shown to have anti-inflammatory properties, which can help to calm redness and irritation caused by conditions such as rosacea, acne, and eczema.
- **Anti-aging benefits:** Tranexamic acid has been shown to help improve skin texture and reduce the appearance of fine lines and wrinkles, likely due to its ability to reduce inflammation and promote collagen production.
- **Brightening effect:** By reducing hyperpigmentation, tranexamic acid can help to brighten the skin and create a more even complexion.
- **Safe for all skin types:** Tranexamic acid is generally considered safe for all skin types, including sensitive skin.

Tranexamic acid is a beneficial ingredient for those looking to address hyperpigmentation, inflammation, and signs of aging in their skin care routine.

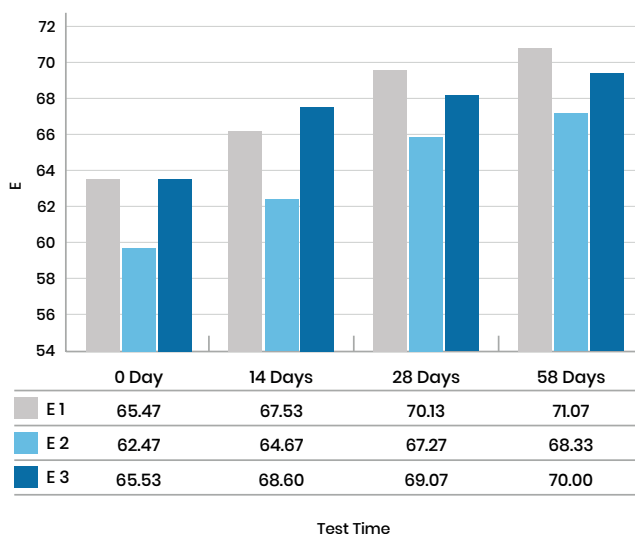
In-vivo test - Skin Lightening & Whitening Results

The L and E improved when using 0.5% Tranexamic Acid, comparing with the untreated.

The value of L (skin Lightness) at different time when used 0.5% Tranexamic Acid



The value of E (skin sensed colour) at different time when used 0.5% Tranexamic Acid



Comparing with the untreated, skin lightness improved significantly, skin lightness increased by 3.74% after 14 days, 6.13% after 28 days, 8.21% after 56 days by treating with 0.5% Tranexamic Acid.

Comparing with the untreated, skin sensed colour improved significantly, skin whiteness improved by 3.74% after 14 days, 6.68% after 28 days, 8.23% after 56 days by treating with 0.5% Tranexamic Acid.

In-ViVo test—Skin Lightening & Whitening Results

Lightening & Whitening Pictures (0.5% Tranexamic Acid subject)

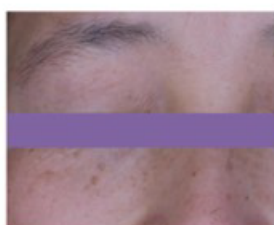


Fig. 1 0 day

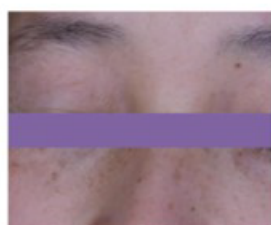


Fig. 2 14 day



Fig. 3 28 day

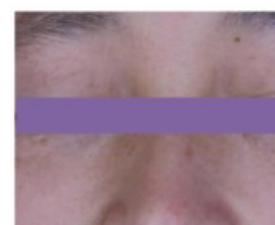


Fig. 4 56 day

In-ViVo test—Anti-Spot Results

Anti-Spot pictures (0.5% Tranexamic Acid subject)

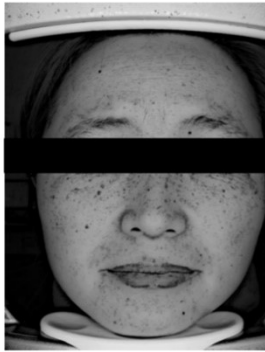


Fig. 1 0 day

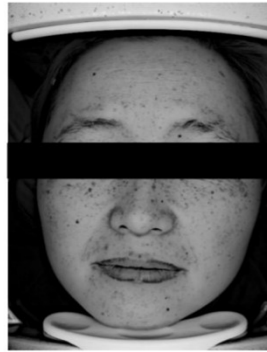


Fig. 2 14 days



Fig. 3 28 days



Fig. 4 56 days

Comparing with the untreated, spot amount & spot area & spot area ratio declined significantly after 14 days. Spot amount declined by 4.17% after 14 days, 8.37% after 28 days, 12.50% after 56 days. Spot area decline 12.04% after 14 days, 18.52% after 28 days, 25.73% after 56 days. Spot area ratio decline 10.81% after 14 days, 18.92% after 28 days, 29.73% after 56 days when treating with (0.5% Tranexamic Acid)

Links:

- <https://pubmed.ncbi.nlm.nih.gov/28374042/>
- <https://pubmed.ncbi.nlm.nih.gov/30533427/>
- <https://pubmed.ncbi.nlm.nih.gov/28283893/>
- <https://pubmed.ncbi.nlm.nih.gov/33518674/>
- <https://pubmed.ncbi.nlm.nih.gov/35388589/>

ACETYL GLUCOSAMINE

| | |
|---|--|
| Increases hyaluronic acid production | Improves the skin's moisture retention |
| Improves skin texture | Reduces the appearance of dark spots and age spots |
| Inhibits the production of melanin | Stimulates the production of collagen and elastin |
| Reduces the appearance of fine lines and wrinkles | |

Acetyl glucosamine is a natural compound derived from the amino sugar called glucosamine. Acetyl glucosamine has many biological functions such as its involvement in the production of hyaluronic acid. When acetyl glucosamine is combined with glucuronic acid, it forms hyaluronic acid. It is a popular ingredient in skincare products due to its ability to improve the skin's texture, reduce hyperpigmentation, and provide hydration. Acetyl glucosamine is similar in structure to hyaluronic acid and works by increasing the skin's production of hyaluronic acid, which in turn helps to keep the skin moisturised and plump.

Acetyl glucosamine has several benefits for the skin, including:

- Hydration: It is a precursor for the biosynthesis of hyaluronic acid. So, Acetyl Glucosamine itself is also an important skin-identical ingredient and NMF (Natural Moisturising Factor). Acetyl glucosamine helps to improve the skin's ability to retain moisture, which can help to prevent dryness and dehydration.
- Exfoliation: Acetyl glucosamine can help to gently exfoliate the skin, which can help to remove dead skin cells and improve skin texture.
- Hyperpigmentation reduction: Acetyl glucosamine has been shown to reduce the appearance of hyperpigmentation, such as dark spots and age spots. It works by inhibiting the production of melanin, which is responsible for skin colour.
- Anti-aging benefits: Acetyl glucosamine has been shown to stimulate the production of collagen and elastin, which are essential for maintaining the skin's elasticity and firmness. This can help to reduce the signs of ageing such as fine lines and wrinkles.

Links:

- <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1473-2165.2007.00295.x>
- <https://pubmed.ncbi.nlm.nih.gov/20725554/>
- <https://pubmed.ncbi.nlm.nih.gov/19691938/>

TOCOPHEROL

| | |
|---|---|
| Protects the skin from oxidative damage caused by environmental stressors | Promotes scar healing |
| Encourages collagen production | Helps to protect the skin from sun damage |
| Promotes skin cell turnover | Potent antioxidant that reduces the signs of ageing |

Tocopherol or Vitamin E is an important fat-soluble antioxidant and has been used for more than 50 years in dermatology. It is an important ingredient in many cosmetic products. It protects the skin from various deleterious effects due to solar radiation by acting as a free-radical scavenger.

One of the most well-known and researched antioxidants for the body and for skin, vitamin E occurs naturally in human skin, but can become depleted due to constant environmental exposure in the absence of sun protection. There are eight basic forms of the entire fat soluble vitamin E molecule, which are either synthetically or naturally derived. The most typical forms are d-alpha-tocopherol, d-alpha tocopherol acetate, d-alpha tocopherol, and d-alpha tocopherol acetate. Research has shown that natural forms of vitamin E are more effective than their synthetic counterparts, but both definitely have antioxidant activity. Vitamin E is an important fat-soluble antioxidant and has been in use for more than 50 years in dermatology. It is an important ingredient in many cosmetic products. It protects the skin from various deleterious effects due to solar radiation by acting as a free-radical scavenger. Experimental studies suggest that vitamin E has photoprotective properties and is a powerful antioxidant.

Links:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4976416>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4976416/>

*Mg/kg

