

CLINICAL DATA – TETRAHEXYLDECYL ASCORBATE

Tetrahexyldecyl ascorbate is a stabilised (heat and oxygen stable), non-acidic, oil soluble vitamin C derivative of ascorbic and isopalmitic acid. It effectively converts into the free vitamin C in the skin. It is ideal in oil-based formulations and lip products.

Tetrahexyldecyl ascorbate is known for its superior percutaneous absorption. It is a potent antioxidant with SOD (superoxide dismutase) like activity and protects collagen from degradation and promotes collagen synthesis (anti-ageing). It's one of the best ingredients to add to your skincare arsenal when treating UV damage, collagen production, hyperpigmentation, environmental free radical damage and skin changes associated with photoageing.

Tetrahexyldecyl ascorbate is approved as a quasi-drug active in Japan at 3%. It is also registered in Korea as a functional ingredient for skin lightening at 2% concentration.

Why tetrahexyldecyl ascorbate? What about pure ascorbic acid?

The skincare benefits of vitamin C are well-researched and well-known (1). But there are a few problems with the use of pure vitamin C aka ascorbic acid.

Vitamin C is an unstable molecule, undergoes rapid oxidation, and almost half of it gets degraded within 30 minutes (1) (2) (29). It can be stabilised to some degree by keeping it at low pH (below pH 3.5), and by adding other antioxidants to the formula (vitamin E, ferulic acid).

When taken orally or applied to the skin, most of the vitamin C never makes it to the target site, that is, to the target body cells. Also, it is difficult to deliver ascorbic acid into the dermis in the optimum dosage (3). Ascorbic acid requires low pH (acidic) environment to be able to penetrate the skin, and this can cause irritation, and dryness to more sensitive skin.

Tetrahexyldecyl ascorbate - A more potent and stable vitamin C derivative

Despite its obvious benefits, the utility of vitamin C is limited. Therefore, researchers have come up with vitamin C derivatives that are more stable, equally effective and comparatively active. One such derivative is tetrahexyldecyl ascorbate. When compared to pure vitamin C (ascorbic acid), vitamin C derivatives are more stable, both in solution and topical forms (4) (29).

Tetrahexyldecyl ascorbate (oil loving) has three times better penetration than ascorbic acid (5) (6) (29). Tetrahexyldecyl ascorbate can produce better results even when used in doses 25 times lower than ascorbic acid (5) (6).

Skincare benefits of tetrahexyldecyl ascorbate

What benefits should you expect following the use of tetrahexyldecyl ascorbate? Here are some beauty benefits of this vitamin C derivative:

- It is a potent antioxidant and inhibits the peroxidation of lipids (7).
- It has anti-ageing benefits (8).
- Protects the skin against UV (Ultraviolet) radiations (9).
- Improves skin brightening by reducing skin melanin production (9).
- Gives your skin a youthful look by improving collagen production (10) and decreasing collagen breakdown (11).

1. Antioxidant benefits of tetrahexyldecyl ascorbate

Your skin is the biggest yet the most sensitive organ of your body. The reactive oxygen species or ROS start to build up in your body as you age. The oxidative stress also increases with the exposure to environmental pollutants and UV radiations (12). Among other body organs, your skin has the highest load of ROS (13).

An increase in oxidative stress wreaks havoc on your skin health. It increases melanin production, hinders the synthesis of collagen, and speeds up the breakdown of already present collagen. As a result, you have a skin full of wrinkles, age spots, and uneven pigmentation (14).

Ascorbate and its derivate molecules are known to act at a cellular level to quench the ROS (15). When compared to simple ascorbic acid, tetrahexyldecyl ascorbate was able to exert free-radical scavenging effects for a longer duration (up to 40 hours). Ascorbic acid, on the other hand, caused maximum free radical elimination within 30 minutes and not after that (16).

2. Anti-ageing properties of tetrahexyldecyl ascorbate

The signs of ageing include wrinkles and collagen loss, uneven skin tone, roughness of the skin and reduced skin brightness. The underlying mechanisms for skin ageing include reduced collagen production, higher photo-damage and a decline in skin hydration. These can be the result of poor nutrition, overexposure to the sun, environmental pollutants, smoking and improper hydration (17).

Ascorbic acid and its derivatives help improve skin appearance and exert anti-ageing benefits due to their ability to improve cell survival, skin hydration, and collagen synthesis (18) (19).

When treated with hydrogen peroxide (a chemical toxic to cells), the survival rate of cells subsequently treated with tetrahexyldecyl ascorbate was 100% compared to control (where the survival was less than 80%) (16).

In a double-blinded, randomised control trial, researchers evaluated the efficacy of tetrahexyldecyl ascorbate-based products in improving signs of ageing. At the end of 12 weeks, almost all the participants noted a significant reduction in wrinkles, uneven skin tone, and experienced improved skin hydration and better skin complexion (20)

3. UV protection offered by tetrahexyldecyl ascorbate

Exposure to UV radiation, either natural or due to tanning can result in several skin complications. UV exposure increases inflammation in the superficial layers of your skin (epidermis and dermis). It damages the very core (DNA) of the skin living keratinocytes and dermal skin cells and makes them die quickly following a process called apoptosis. Moreover, UV rays increase your skin thickness and increase skin melanin production as well. What you are left with is a skin that is thick, coarse, wrinkled skin and hyper-pigmented (21).

Tetrahexyldecyl ascorbate achieves an excellent penetration within the skin keratinocytes and helps them fight against the harmful effects of UV radiation. Cells treated with tetrahexyldecyl ascorbate have a 30% better penetration rate to target cells compared to pure vitamin C.

p53 is a cellular protein that makes your body cells commit suicide (apoptosis). When treated with Tetrahexyldecyl Ascorbate, the UV-exposed cells have a less than 20% expression of p53 compared to control (16).

4. Tetrahexyldecyl ascorbate inhibits melanogenesis

Your skin contains a variety of cells and one of them is melanocytes. Melanocytes produce a skin pigment called melanin. Melanin is a black-colored pigment that protects your skin from the UV damage (22). But too much, or excess production of this pigment can result in a dark skin complexion, hyperpigmentation and uneven skin tone.

The production of melanin is a multi-stage process and is facilitated by several enzymes. Most of the whitening skin ingredients have a melanin lowering effect mainly due to their ability to reduce the activity of tyrosinase, an enzyme critical for melanin synthesis. In addition to reducing tyrosinase activity, it also reduces melanin

production by strengthening the intrinsic antioxidant mechanisms of the body which offer protection against melanin production secondary to UV exposure (23).

Laboratory testing have shown that treatment of skin cells with tetrahexyldecyl ascorbate can reduce melanogenesis by 80% (16). This fact has been backed by clinical studies as well where the use of tetrahexyldecyl ascorbate-based products resulted in significant skin brightening and a reduction in melanogenesis (6) (8) (9) (24) (25).

5. Tetrahexyldecyl ascorbate boosts skin collagen

Collagen is one of the most important proteins in your skin. It is responsible for maintaining the basic skin architecture and gives the skin support, firmness and a supple, youthful appearance. With age and due to the exposure to environmental toxins and pollutants, your skin starts to lose its collagen reserves. One of the several culprits for increased collagen breakdown is Matrix Metalloproteinase (MMP) production. This enzyme causes a rapid breakdown of skin collagen (26).

Treatment of skin cells with ascorbate-based products can cause up to 8-folds increase in collagen synthesis (10). When compared to simple ascorbic acid, tetrahexyldecyl ascorbate caused a 50% increase in the skin collagen synthesis. Moreover, it also causes a substantial decline in the activity of MMP collagen-degrading enzymes (16).

To conclude, tetrahexyldecyl ascorbate is a potent anti-ageing, antioxidant, melanin suppressing, and collagen boosting skincare ingredient with an impressive safety profile. It more effective, safe, and potent and it ideal for oil-based formulations and lip products.

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