Avena Lab
Farmadria d.o.o. Since 1991.

Import and distribution for Serbia: Farmadria DOO
info@avenalab.com
+381 (0) 69 / 55 65 029
www.avenalab.com

TECHNICAL DATA SHEET

Product Name: Vitamin E Tocophersolan (Water-soluble Vitamin E)

INCI Name: d-Alpha Tocopheryl Polyethylene Glycol 1000 Succinate (TPGS)

CAS: 9002-96-4

Chemical Classification: Semi-synthetic vitamin E derivative; ester of α-tocopherol and polyethylene glycol; amphiphilic compound (PEG ester)

Functional Category: Antioxidant, solubilizer, emulsifier, mild surfactant, carrier and penetration enhancer of active substances

IUPAC Name: 2-(poly(oxyethylene))-ethyl hydrogen succinate ester of (2R)-2,5,7,8-tetramethyl-2-(4,8,12-trimethyltridecyl)chroman-6-ol

Description: Vitamin E tocopheryl polyethylene glycol succinate (TPGS) is a semi-synthetic derivative of vitamin E, obtained by esterification of natural tocopherol with polyethylene glycol succinate. Due to this structural modification, TPGS exhibits both hydrophilic and lipophilic properties, making it particularly suitable for stabilizing systems that contain both aqueous and oil phases. In cosmetics, TPGS is used as a functional antioxidant and solubilizing carrier that contributes to the stability of sensitive lipophilic active substances, such as other forms of vitamin E, coenzyme Q10, and botanical extracts, unlike conventional tocopherol, which has limited water solubility. On the skin, TPGS retains the biological activity of vitamin E, contributing to the protection of lipid structures against oxidative stress and free radicals, while simultaneously demonstrating improved bioavailability due to its surfactant nature. This property enables more efficient transport of active substances through the superficial layers of the skin without compromising the skin barrier function. Because of its mild activity profile and good skin compatibility, it is often used in formulations intended for sensitive regions, such as the eye area. Its use is particularly valued in modern cosmetic formulations where a combination of antioxidant protection, functional stability, and a pleasant sensory profile is required. Vitamin E TPGS is a solid substance with a waxy consistency at room temperature. It is typically white to pale yellow in color, odorless or with a very mild, neutral odor. The material is slightly hygroscopic but stable when properly stored. It shows good dispersibility and solubility in water, forming clear to slightly opalescent solutions due to its ability to form micelles. In organic solvents and oils, it behaves as a

Avena Lab
Farmadria d.o.o. Since 1991.

Import and distribution for Serbia: Farmadria DOO
info@avenalab.com
+381 (0) 69 / 55 65 029
www.avenalab.com

TECHNICAL DATA SHEET

compatible amphiphilic substance with good interfacial properties. The melting point typically ranges from approximately 37–41 °C, meaning that at slightly elevated temperatures it transitions into a semi-liquid state. For this reason, it is often added during the final stage of formulation at lower temperatures in order to preserve its structure.

Mechanism of Action: Vitamin E TPGS (tocophersolan) is a form of vitamin E that has been chemically modified to be water-soluble. It is formed by linking natural α-tocopherol to a succinate group, which is then bound to a polyethylene glycol chain with an average molecular weight of approximately 1000 Da. As a result, the molecule has two distinct domains: a lipophilic part derived from vitamin E and a hydrophilic part formed by the PEG chain. This combination gives TPGS amphiphilic properties, allowing it to function in both aqueous and lipid environments. The succinate linkage provides molecular stability while allowing sufficient flexibility for the molecule to organize into small structures such as micelles in water, which are essential for its functionality in cosmetic formulations. In aqueous systems, Vitamin E TPGS forms micelles capable of encapsulating lipophilic active ingredients and distributing them evenly throughout the formulation. The hydrophilic PEG segment ensures good dispersion and stability in water, while the lipophilic vitamin E segment has a natural affinity for skin lipids. This facilitates closer contact of active substances with the superficial layers of the skin and promotes more effective distribution without damaging the protective barrier. At the same time, vitamin E retains its antioxidant role, protecting skin lipids and the formulation itself from oxidation and free radical damage. For this reason, TPGS is commonly used in cosmetics as a functional carrier that improves product stability, evens out texture, and enhances the delivery of active ingredients, particularly in serums, gels, and lightweight emulsions.

Benefits

- As a water-soluble form of vitamin E, it is suitable for use in serums, gels, and emulgels.
- Acts as an antioxidant that protects skin lipids and formulations from oxidative degradation.
- Facilitates penetration of active ingredients through the superficial layers of the skin without compromising the skin barrier.
- Contributes to emulsion stability and uniform distribution of lipophilic components in the aqueous phase.

Avena Lab
Farmadria d.o.o. Since 1991.

Import and distribution for Serbia: Farmadria DOO
info@avenalab.com
+381 (0) 69 / 55 65 029
www.avenalab.com

TECHNICAL DATA SHEET

• Improves product texture and provides a lighter, less greasy sensory feel on the skin.
• Reduces the need for more aggressive solubilizers in formulations.
• Suitable for formulations intended for sensitive regions, such as the eye area, due to its low irritation potential.

Directions for Use: Vitamin E TPGS is most commonly added during the final stage of formulation, after the basic structure of the product has already been formed. Processing at temperatures below 40 °C is recommended to preserve molecular stability and antioxidant activity. It can be pre-dispersed or dissolved in a small portion of the aqueous phase and then uniformly incorporated into the system with gentle mixing. In aqueous serums and gels, it is typically used at low concentrations, most often from 0.1 to 0.5 %, where it provides a water-soluble form of vitamin E and contributes to the stability of active ingredients. In emulgels and light O/W emulsions, concentrations usually range from 0.3 to 1 %, as it supports solubilization and uniform distribution of lipophilic components in addition to its antioxidant role. In anti-age creams and lotions, it is most commonly used at around 0.5 %, representing a balance between functionality and formulation stability. When TPGS is applied primarily as a carrier or penetration enhancer for active substances, concentrations are kept in the low to mid range to achieve the desired effect without impacting sensory properties. In formulations intended for sensitive regions, such as the eye area, lower concentrations, typically up to 0.3 %, are recommended.

Comparative Advantages: Compared to Vitamin E (dl-alpha tocopheryl acetate 98 %), Vitamin E TPGS offers several clear advantages, primarily related to formulation flexibility and functionality in modern cosmetic systems. Its key advantage is water solubility, which allows its use in aqueous and predominantly aqueous formulations such as serums, gels, and emulgels, where tocopheryl acetate cannot be applied directly without additional solubilizers. Tocopheryl acetate is strictly lipophilic and limited to the oil phase or classical emulsions. Due to its amphiphilic structure, TPGS functions not only as an antioxidant but also as a solubilizing carrier that improves the stability and distribution of other lipophilic active ingredients in the formulation. Tocopheryl acetate primarily serves as a stable depot form of vitamin E and does not contribute to system structure or stability. Vitamin E TPGS enables improved bioavailability and more efficient skin contact, as it forms micelles in aqueous environments that facilitate delivery of active substances to the superficial layers of the skin. Tocopheryl acetate must first

Avena Lab
Farmadria d.o.o. Since 1991.

Import and distribution for Serbia: Farmadria DOO
info@avenalab.com
+381 (0) 69 / 55 65 029
www.avenalab.com

TECHNICAL DATA SHEET

be hydrolyzed in the skin to become biologically active, resulting in a slower and less predictable effect. From a formulator's perspective, TPGS often reduces the need for additional surfactants and solubilizers, whereas tocopheryl acetate requires a suitable oil phase and a stable emulsifier system. TPGS also contributes to a lighter texture and a less greasy sensory profile in the finished product. While tocopheryl acetate is chemically very stable and suitable for traditional creams and oils, Vitamin E TPGS offers broader applicability, higher functionality, and greater flexibility in the development of modern, lightweight cosmetic formulations.

Natural or Synthetic Ingredient: Vitamin E TPGS (tocophersolan) is a semi-synthetic ingredient. It is obtained through chemical modification of natural vitamin E (d-α-tocopherol), which is most commonly extracted from plant sources such as soybean or sunflower oil, followed by esterification with a succinate group and linkage to polyethylene glycol. Due to this controlled chemical processing, it is not considered a natural ingredient in the strict sense, although its origin is partially derived from natural sources.

Animal Testing: Not tested on animals

GMO: Non-GMO

Vegan: Contains no animal-derived components

Storage: Store protected from light in a cool, dry place