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TECHNICAL DATA SHEET

Product Name: Betaine

INCI Name: Betaine

CAS: 107-43-7

Functional Category: Humectant; skin and hair conditioning agent; osmoprotectant; irritation-reducing agent

Description: Betaine is a natural osmolyte, i.e., a molecule that cells use to regulate osmotic pressure and maintain a stable internal environment without disrupting cellular structures and metabolic processes, and a derivative of the amino acid glycine that is primarily used in cosmetic formulations due to its pronounced moisturizing and protective effects on the skin and hair. In nature, it is present in plants, especially sugar beet, as well as in humans and animals, where it plays an important role in regulating cellular osmotic balance. In cosmetics, highly purified betaine is used—industrially produced, with a controlled composition and consistent quality. On contact with the skin, betaine acts as an effective humectant that helps cells retain water and maintain an optimal hydration level, even under exposure to surfactants, alcohol, or other potentially drying ingredients. Its action is not based only on water attraction, but also on stabilization of cell membranes and proteins, contributing to improved resistance of the skin to external stressors. For this reason, it is frequently used in formulations intended for dry, dehydrated, and sensitive skin, as well as in products for everyday use. Betaine plays a significant role in improving the tolerability of formulations. It has been shown to reduce the irritant potential of anionic and amphoteric surfactants, so it is often included in shampoos, shower gels, and facial cleansers. In such products, it helps preserve the hydrolipid barrier of the skin and reduces the feeling of tightness after rinsing. At the same time, it does not negatively affect cleansing efficacy or foam stability. In hair products, betaine improves hair fiber hydration, increases elasticity, and contributes to a softer, smoother feel without weighing the hair down. It does not form a film that burdens the hair and is compatible with a wide range of conditioning ingredients. Due to its chemical nature and neutral charge under physiological conditions, betaine shows excellent compatibility with emulsifiers, thickeners, active substances, and preservatives, without affecting the color, odor, or texture of the finished product. Thanks to its high water solubility and stability over a wide pH range, betaine is a technologically simple and reliable ingredient, suitable for modern formulations intended for sensitive

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areas, such as the eye area, as well as for products that aim for a mild, skin-like performance profile.

Mechanism of Action: The mechanism of action of betaine is based on its role as an osmoprotectant and stabilizer of cellular structures. As an osmolyte, betaine accumulates inside cells and in their immediate surroundings, where it regulates osmotic pressure and enables water retention without compromising the integrity of cell membranes and protein structures. In this way, it helps skin and hair cells maintain optimal volume and functionality even under exposure to drying factors. At the same time, betaine stabilizes protein structures and lipid membranes, reducing protein denaturation and disruption of lipid organization caused by surfactants, alcohol, or changes in humidity. This effect directly contributes to reduced irritation and preservation of the skin's hydrolipid barrier. In cleansing formulations, betaine works by mitigating surfactant harshness, reducing their negative impact on skin and hair without decreasing cleansing efficiency. On the skin surface, betaine contributes to increased water content in the stratum corneum and improved elasticity, while in hair products it facilitates moisture retention in the hair fiber and improves flexibility. Due to this mechanism of action, betaine acts not only as a classic humectant, but also as a functional regulator of cellular stress, providing a longer-lasting and physiologically balanced effect of hydration and protection.

Physicochemical Properties: Betaine is a white to slightly cream-colored crystalline substance or fine powder, odorless, with a slightly sweet taste characteristic of this class of compounds. It is very soluble in water, where it rapidly forms clear and stable solutions, while it is practically insoluble in oils and most nonpolar organic solvents. Due to its pronounced hydrophilicity and water-binding capacity, it exhibits mildly hygroscopic behavior, so storage in tightly closed packaging protected from moisture is recommended. In aqueous solutions, betaine is chemically stable and shows a slightly acidic to neutral reaction, with pH values consistent with the physiological pH range of the skin, contributing to good tolerability. It does not undergo hydrolysis or oxidation under typical cosmetic conditions and is stable across a wide temperature and pH range typical for skin and hair care products. At elevated temperatures, it does not melt in the classic sense, but decomposes only at significantly higher temperatures, which have no practical relevance in cosmetic manufacturing. Due to its zwitterionic nature, betaine shows high compatibility with anionic, nonionic, and amphoteric surfactants, as well as with emulsifiers, thickeners, and preservatives. It does not affect the color, odor, or

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texture of the finished product and does not cause clouding of aqueous systems when properly dosed. This set of physicochemical properties makes betaine a stable, technologically simple, and reliable ingredient for a wide range of modern cosmetic formulations.

Benefits:

- Increases skin and hair hydration by helping cells retain water.
- Protects cells from osmotic stress and dehydration.
- Strengthens the skin barrier and reduces the feeling of tightness.
- Reduces the irritant potential of surfactants in cleansing products.
- Improves the tolerability of formulations intended for sensitive areas, such as the eye area.
- Contributes to a softer and smoother skin feel without stickiness.
- Increases hair fiber elasticity and flexibility.
- Does not clog pores and is suitable for all skin types.

Method of Use: In cosmetic formulations, betaine is added to the water phase, where it dissolves quickly and completely with gentle mixing, without the need for additional heating. It can be added at the initial stage of preparing the water phase or in the final stage of the formulation, as it does not negatively affect system stability or the performance of other ingredients. Due to good chemical stability and neutral behavior over a wide pH range, it is compatible with most active substances, surfactants, emulsifiers, and thickeners. In moisturizing creams, lotions, and serums, betaine is most commonly used at concentrations of 1 to 5%, where it contributes to longer-lasting hydration and improved product tolerability. In gels and light-texture emulsions, typical concentrations range from 0.5 to 3%, depending on the targeted moisturizing effect. In skin and hair cleansing products such as facial cleansing gels, shampoos, and shower gels, betaine is usually applied in the range of 1 to 4%, where it effectively reduces surfactant irritation without diminishing cleansing ability or foam stability. In formulations intended for sensitive areas, such as the eye area, lower concentrations are used, most often 0.5 to 2%, to ensure maximum tolerability. In hair products, including conditioners, masks, and leave-in formulations, betaine is used at concentrations of 1 to 3%, where it improves hydration, elasticity, and softness of the hair fiber. In all cases, adapting the concentration to the product type and intended purpose is recommended, along with confirming pH stability in the final formulation.

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Comparative Advantages: Betaine has a pronounced advantage over classic humectants because, in addition to binding water, it actively protects cells from osmotic stress and stabilizes the protein and lipid structures of the skin. Unlike glycerin, which at higher concentrations can leave a sticky feel, betaine provides pleasant, non-sticky hydration with a better sensory profile. Compared to propanediol and butylene glycol, betaine shows significantly better tolerability in sensitive skin and a lower irritation potential. Compared to sodium PCA, betaine is more stable in the presence of surfactants and alcohol, making it more suitable for cleansing products and formulations with harsher systems. Unlike some amino acids that can affect formulation pH, betaine behaves neutrally and does not require additional pH adjustments. Compared to sugar humectants such as sorbitol, betaine shows a lower tendency toward stickiness and crystallization on the skin surface. In hair products, betaine has an advantage over heavy cationic conditioners because it does not weigh the hair down or reduce volume, while still improving elasticity and softness. Due to its exceptional compatibility with a wide range of ingredients and stability in different formulations, betaine is considered a more technologically flexible and universal ingredient compared to many classic moisturizing and soothing components.

Natural or Synthetic Ingredient: Betaine is a natural ingredient because it occurs naturally in plants, especially sugar beet, as well as in humans and animals. In the cosmetic industry, industrially produced betaine is used, most often isolated from plant sources or produced through controlled technological processes, ensuring high purity, consistent quality, and a reproducible ingredient composition.

Animal Testing: In accordance with current European regulation (Regulation (EC) No. 1223/2009 on cosmetic products), the substance has not been tested on animals. The safety assessment of the ingredient is based on available toxicological data, scientific literature, and validated alternative testing methods (in vitro and in silico). In silico is a term used for testing and assessment methods carried out using computer models and simulations, rather than in the laboratory on living organisms (in vivo) or on cell cultures (in vitro). This note confirms compliance with the ban on animal testing and is provided solely for informational purposes for further use of the ingredient in cosmetic formulations.

GMO: Non-GMO

Vegan: Does not contain ingredients of animal origin