ROXLOR International

Fine Functional Food Ingredients

Cynatine® HNS

Technical Information Regarding Cynatine® HNS

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The Roxlor Group

Roxlor is highly experienced in the commercial development of technically advanced, unique nutraceutical and cosmeceutical ingredients sourced from all parts of the world. Its core product lines center on ingredients that improve the health characteristics of finished consumer products. Current unique products which Roxlor supplies include Cynatine® FLX, Cynatine® HNS, JamboLean®, RoxPlus®, Lunasin XP® and EnzyBoost™.

In addition to the unique ingredients that Roxlor supplies, it also manufacturers two piece hard gelatin capsules in Europe.

Roxlor International is the US distribution arm of the Roxlor Group as well as distributing a line of sweet fiber masking and flavoring products.

Soluble Keratin:

Keratin is a protein found throughout the body. Keratin not only has an important structural role in skin, hair, nails and the quills of feathers. This intriguing protein also has one of the highest proportions of the amino acid cysteine, a natural reservoir of sulphur and an antioxidant used in many biological reactions. Much of the structural strength of keratin comes from cysteines, which bridge to form a cystine link.

The ability to convert natural keratin into a functional form that is bio-available to the body is a recent breakthrough. Keratec Ltd has developed a patented process that enables the intact keratin molecule to be solubilized and therefore making it both bioactive and bio-available to the body. The result is the world's first "*Solubilized Keratin*" .

Cynatine® HNS - Revolutionary Cosmeceutical:

Cynatine® HNS is a natural bioactive keratin, that is clinically proven to improve the strength and appearance of hair as well as reduce hair loss. It has been demonstrated to be capable of both reversing the effects of aging skin and also protecting the skin against future damage as well as improving the strength and luster of nails.

Cynatine® HNS consists of a unique biomaterial called "Intermediate Filament Protein," produced from the unique source of natural New Zealand keratin fiber. This form of keratin is unlike the "denaturalized" keratin fragments which are available today as a by-product of the meat processing industry. In today's cosmetic world, the keratin which is offered in the market for skincare and personal-care applications is no longer bioactive or particularly functional. Instead it has been "denaturalized" through a large scale industrial rendering process, which applies both high temperature and acid to by-products such as hooves, horns and feathers. The process renders these fragments inactive to the human body. By comparison, the Keratec approach involves a patented process, using a gentle method of keratin solublization. This process is performed on a high value, high quality raw material, which has been specifically selected for the task. This IFP protein is then broken down into its peptide forms for ingestible application in order to ease its assimilation into the body. Cynatine® HNS makes it possible for the first time for the body to digest natural keratin in safe and bioavailable form.

Cynatine® keratin differs from any materials previously produced commercially in 3 ways

1. Individual members of the keratin protein family are isolated separately, the fibrous intermediate filament proteins are isolated separately to the globular matrix proteins. Each has distinct features (size, amino acid profile) and activity. No one has previously been able to purifiy different fractions in the active form, rather keratin has been used as one heterogenous mixed material with low bioactivity.
2. Cynatine® proteins can be maintained intact, with regards to size and amino acid character, and are therefore closer in form and function to the native keratins found in skin, hair, nails and other tissues than any keratin materials previously produced commercially, which are generally hydrolyzed leading to loss of key aspects of form and function. .
3. The amino acid cysteine, the defining feature of keratin proteins, is reversibly protected in the S-$SO3^-$ (s-sulfonate form), maintaining solubility and stability, but also the inherent activity of the amino acid cysteine. Previous methods of keratin solubilization utilize harsh methods (acid or alkali hydrolysis) which render the cysteine inactive through irreversible modification, for example oxidation to cysteic acid.

Another feature of Cynatine® HNS is the stable complex, which is naturally formed between the Cynatine® HNS and trace metals that are well know as vital for skin, hair and nail development, such as zinc, copper and iron. This metal -protein complex has been shown to have a beneficial effect on hair, nails and skin. The patented process of manufacture ensures that the Cynatine® HNS remains both bio-available to the body, and highly effective at supporting and maintaining healthy and youthful looking hair, nails and skin.

Cynatine® HNS is clinically proven to:

- Improve the strength of Hair
- Improve the shine and brightness of Hair
- Reduce Hair loss

Cynatine® HNS is capable of binding with the Nail and providing improved strength, elasticity and moisture retention.

Cynatine® HNS has a Four-Fold Action in fighting the visible signs of aging in the Skin:

- Reduces Fine Lines and Wrinkles
- Promotes Firmness and Elasticity in Skin
- Reduces Redness Associated with Inflammation or Sensitive Skin
- Improves the Brightness and Radiance of the Skin

Cynatine® HNS: HAIR

Because of its unique bioavailability, Cynatine® HNS is capable of binding to the keratin which naturally comprises the majority of hair. Because it binds to the hair, it improves the strength and health of the hair. This leads to less breakage, improved shine and brilliance as well as a reduction in hair loss.

A clinical study was performed on Cynatine® HNS which showed that over 90 Days, hair loss from washing was reduced by 30%, Hair strength was improved by 12% and a huge improvement in the shine and brightness of the hair was observed.

The Clinical Study is available under separate cover. Please contact Roxlor to inquire about the clinical report.

Cynatine® HNS: NAILS

Cynatine® HNS, in its bioavailable form, is capable of binding to the nail in order to provide additional strength and moisture retention. Because of Cynatine®'s unique chemistry where it is capable of remaking disulphide bonds in the body, it is capable of joining with the nail in order to increase its integrity. This increased integrity means the structure of the nail is strengthened and the moisture binding properties are improved, resulting in improved flexibility.

Cynatine® HNS: SKIN

Cynatine® HNS influences four key biological mechanisms important in reversing the effects of aging skin and also protecting the skin against future damage. A strong body of scientific data supports each of the four mechanisms of action.

1. Cynatine® HNS Reduces Fine Lines and Wrinkles

In recent years, researchers have developed a putative model for skin aging which suggests there are two principle causes in age related fine lines and wrinkles; 1) the intrinsic progression of skin aging, which is genetic and 2) the extrinsic progression of skin aging, which is environmental. There has been a recent focus of research and development activity to identify how these environmental factors impact aging, since this is the part of the process we have most control over. (Yaar M; J Dermatol Surg Oncol. 1990 Oct;16(10):915-22) (Weinert BT: J Appl Physiol 95: 1706-1716, 2003)

The progress of cellular aging begins with a very gradual slowing of skin cell activity, including change in the rate and quality of collagen production. (i.e. older fibroblasts produce more in-elastic type 1 collagen than type 3 collagen) Skin cells start to slow the rate of cell turnover and cells shed more slowly, often resulting in a dull and uneven complexion. (http://www.aad.org/public/News/NewsReleases/time.htm)

By contrast, those with a genetically younger looking skin, benefit from not just a higher rate of cellular turnover with a greater proportion of those cells being in their “active” phase and producing structural proteins such as collagen type 3, found in predominantly youthful skin and keratinocytes that build the outer epidermis. Finding ways to support the proliferation of new and active fibroblasts and keratinocytes has been the target of much research in cosmetic dermatology.

The importance of the relationship between the production of structural proteins and the proliferation of the cells that make them was demonstrated recently in a study published in Archives of Dermatological Research, where it was concluded wrinkle formation occurred from deterioration of the fibrous ultrastructure in the skin. The initiation of wrinkle formation was shown to be caused from decreases in the elastic properties of keratin in the stratum corneum. (Sano T, et al; 2005, VOL 296; NUMB 8, pages 359-365)

In addition to the effect of improving cell proliferation, there is scientific evidence indicating the way in which the natural copper and zinc help to boost the action of protecting new skin cells and improving overall skin health.

Both zinc (Zn) and copper (Cu), once bound to either a protein or peptide, have been shown to be very effective in regenerating new tissue and increasing the synthesis of structural proteins like collagen.

The zinc-protein complex is useful for both repair and maintenance, and the protection or defense of the skin. Several studies have shown that greatest benefit of zinc in a topical application may come from a long-lasting, slow release form. (Schwartz et al, Dermatol Surg 31:7 Part 2: July 2005)

Certain metal-dependent enzymes are also thought to increase the natural tissue building processes and the production of Glycosaminoglycan (GAGs) found in the extracelluar matrix (ECM) of skin. The role of the ECM is two fold, not only does the ECM add structural integrity to the micro-architecture of the dermis, but it also provides the structural environment for fibroblasts to proliferate. (Yannas IV; Proc Natl Acad Sci U S A. 1989 February; 86(3): 933–937).

Scientific data indicates that the soluble keratin in Cynatine® HNS can promote the proliferation of skin fibroblast and keratinocyte cells.

In vitro testing has demonstrated clearly that Cynatine® HNS keratin stimulates skin cells to proliferate at a rate of up to 160% greater than that of the control. This is an essential first step in the body's production of structural proteins. Increased production of collagen and increased thickness of the epidermis will result in a change in the microarchitecture of the skin. This translates into a reduction of fine lines and reduction in the depth of wrinkles (refer **Figure 1)**

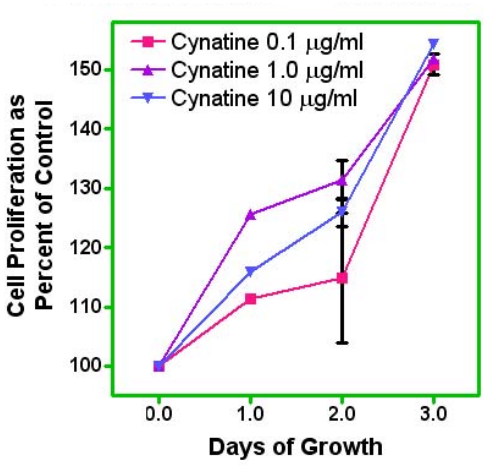

Figure 1 - Cynatine® HNS stimulates cells to proliferate.

In addition to the direct effect of cell proliferation, Cynatine® HNS contains a stable metal-protein complex that the keratin forms with zinc. This metal is bound to either a protein or peptide, which is involved regenerating new tissue.

2. Cynatine® HNS Promotes Firmness and Elasticity of the Skin

Healthy skin cells maintain a moisture barrier just below the outer surface of the skin. This barrier keeps moisture in the body, thereby promoting firmness and elasticity and preventing skin from drying out (Rawlings, A.V, et al ; Dermatol Ther, *17 Suppl 1:*43-48, 2004). The process of aging reduces skin firmness and elasticity because the process causes the skin to dry and it is consequently less able to replace and grow new cells.

Harsh soaps also damage the skin barrier (Bryant, R.A. et al; Ostomy Wound Manage, *47:*18-27, 2001). By promoting skin cell growth, Cynatine® HNS helps to maintain the moisture barrier, reducing skin dryness and promoting firmness and elasticity. A major component of the moisture barrier is cysteine-rich keratin, like the cysteine-rich keratin found in Cynatine® HNS. Damage to the keratin in this barrier can also result in increased skin wrinkles (Sano, T., et al; Arch Dermatol Res, *296:*359-365, 2005). Cynatine® HNS not only helps skin cells support the essential moisture barrier but also provides some of the structural precursors to build the barrier and helps prevent wrinkles.

3. Cynatine® HNS Reduces Redness Associated with Inflammation or Sensitive Skin

Studies have shown that many age-related health problems exhibit defective cysteine metabolism (Bradley et al; *J Rheumatol* **21**:1192-1196.1994), (Kontny et al; *Amino Acids* **23**:415-418. 2002). Cysteine is especially important for promotion of connective tissue health, like that found deep in the dermal region of the skin, because increasing cysteine increases levels of cysteine dioxygenase (CDO), an enzyme which generates natural inorganic sulfate and ultimately taurine from cysteine (Tappaz; *Neurochem Res* **29**:83-96. 2004), (Wilkinson et al; *Toxicol In Vitro* **16**:481-483. 2002).

A major inflammatory mediator which is produced by pro-inflammatory lymphocytes (as well as other cell types) is interleukin-1 (IL-1). IL-1 then stimulates production of many inflammatory molecules, the most significant inflammatory and pain mediator is prostaglandin E2 (PGE2). High levels of PGE2 are a significant cause of chronic inflammation in tissues (Fahmi; Curr Opin Rheumatol. Sep;16(5):623-7. 2004) and suppression of PGE2 has long been recognized as a therapy for the symptoms associated with localized inflammation. Cynatine® HNS reduces the IL-1 stimulated production of PGE2 **(Figure 2)**, demonstrating a very significant anti-inflammatory effect.

One way Cynatine® HNS might exert an anti-inflammatory effect is through the natural CDO enzyme, discussed above. Taurine generated via CDO from Cynatine® HNS is an important anti-inflammatory. Taurine scavenges hypochlorous acid generated by neutrophils and the resultant taurine-Cl is an anti-inflammatory compound that is deficient in people with poor health (Kontny et al. 2002, Tappaz 2004). Using Cynatine® HNS will increase the anti-inflammatory taurine-Cl, helping reduce inflammation.

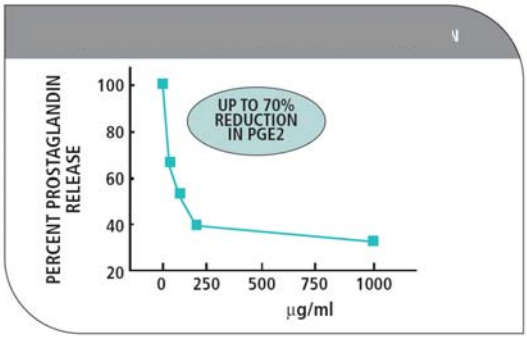

Figure 2 - Cynatine® HNS is an anti-inflammatory, significantly suppressing the prostaglandin E2 response to pro-inflammatory interleukin-1

4. Cynatine® HNS Improves the Brightness and Radiance of Skin

Dead skin cells, or cell senescence, reduce tone and radiance, whereas healthy skin cells give skin a radiant glow. A major reason why healthy skin loses its vitality, or becomes senescent, is through the process of oxidative stress. Oxidative stress, associated with UV exposure and other environmental pollutants, will cause melanogenesis (the production of brown colour pigments, melanin, associated with tanned skin). Healthy skin cells actively fight the damaging effects of the sun on skin because the cells produce glutathione and other antioxidants as a defence mechanism to fight damaging free radicals. Free radicals, generated by oxidants or reactive oxygen species (ROS), are a primary cause of skin damage due to the sun (Briganti, S. J Eur Acad Dermatol Venereol, 17:663-669, 2003). Antioxidants are proven to slow the sun's damage in experimental animals and cells (Cesarini, J.P., et al;. Photodermatol Photoimmunol Photomed, *19:*182-189, 2003.), (Kitazawa, M., et al Photochem Photobiol, *81:*970-974, 2005), (Zhao, Y., et al; Cancer Res, *65:*1401-1405, 2005).

The ability of Cynatine® HNS to protect the skin from oxidative stress has been determined through a combination of in vitro and in vivo measurement. Experimental data reveals that ingested Cynatine® HNS helps to build the cells' glutathione supply, resulting in an increase in serum levels of glutathione-dependent peroxidase **(Figure 3A),** a primary defence against oxidative skin damage (Matsuo, M., et al ; Gerontology, 50:193-199, 2004). Increased levels of a second antioxidant defence enzyme, superoxide dismutase, was also observed **(Figure 3B),** as well as reduced levels of malondialdehyde, an indicator of oxidative damage **(Figure 4).**

This data demonstrates that Cynatine® HNS acts as a **"Force Multiplier for the Skin's Natural Defence"** by increasing the activity of SOD and glutathione.

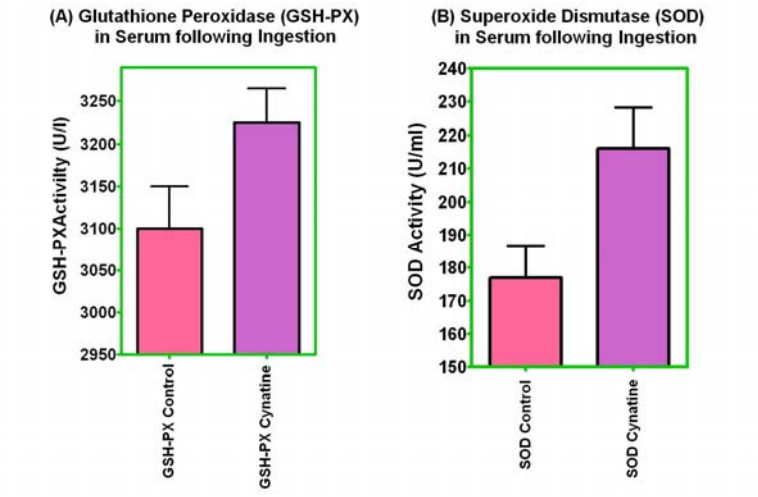

Figure 3 - Orally ingested Cynatine HNS activates the antioxidant enzymes GSH-PX (A) and SOD (B).

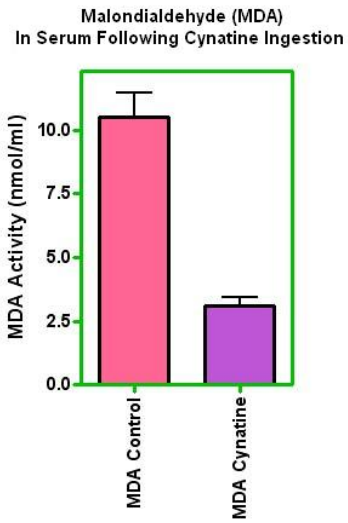

Figure 4 - Orally ingested Cynatine HNS reduces harmful levels of MDA.

Cynatine® HNS can also provide direct protection from oxidative stress. Keratec's patented purification process yields Cynatine® HNS with intact natural cysteine which has a high level of antioxidant activity. The cysteine acts as an antioxidant in cells, providing them with direct protection against ROS, which helps to maintain the skin's antioxidant status and prevents oxidative stress from occurring. The direct antioxidant capacity of Cynatine® HNS is greater than that of common dietary sources of antioxidants. Cynatine® HNS has about 2100 µmol TEAC/100 g antioxidant activity.

Keeping skin cells healthy, by helping the skin protect itself from oxidative damage, will lead to improvement in the brightness and radiance of skin.

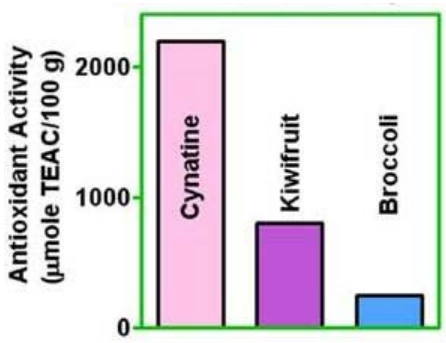

Figure 5 - Cynatine FLX is an excellent antioxidant.

Physical Properties:

As a dietary supplement, Cynatine® HNS is available as a powder. Cynatine® HNS is a white to off white, free flowing, soluble powder with general use in tablets, capsules beverages and just about nay other delivery system.

Usage Indications/Dosage:

Cynatine ®HNS is recommended as a dietary supplement for people concerned about improving the health and look of their Hair, Nails and Skin. Cynatine® HNS has a split dosage recommendation. As a stand alone supplement its dosage is recommended at 500mg per day. Cynatine® is stable over a wide range of pH's and elevated temperatures.

Source:

Cynatine® HNS is made from keratin extracted from premium quality pure New Zealand wool using Keratec's unique patented process. Wool is sourced from selected farmers we trust with protocols that ensure complete traceability.

New Zealand is composed of two main islands in the South Pacific and has one of the world's most stringent biosafety regimes. Notwithstanding New Zealand's natural high standard of biosafety, Keratec has implemented a strict protocol specifying the highest quality wool and rejects any not meeting these criteria.

Because wool is a natural material that can vary between flocks and breeds, Keratec has developed its own wool specification defining the standards required of farmers. In addition, Keratec has direct contracts with the farmers who supply the wool. To ensure the wool supplied meets Keratec's exacting standards, we have selected specific flocks of a particular breed with a documented genetic heritage. We pay growers a significant premium to ensure that only the highest quality wool is supplied.

The Keratec suppliers have been chosen for their:

- Best practice farming
- High quality wool harvesting processes
- Specifically sorted wool
- Commitment to supplying top quality raw materials

The Keratec supply contract and quality systems provide:

- Guaranteed traceability from a particular flock's wool to the finished Keratec product.
- Quality assurance consistent with ISO9001:2000 standards
- Keratec sources wool from farmers located in the Canterbury area of New Zealand.

Pure New Zealand wool is a 100% natural material. Sheep farmed on New Zealand's unspoilt high country grow a thick fleece of wool to protect themselves from the harsh winter. This wool is harvested during spring by shearing, which is like a haircut using electronic clippers. Once they have been shorn, the animals return to the fields to continue grazing and raising their young, free of their heavy fleece during the long, hot summer. The fleece grows back in fall, ready for the coming winter.

No animals are harmed at any stage of the wool harvesting process.

Amino Acid Profile:

Cynatine® HNS is a protein/peptide form of keratin with a molecular weight of 800 to 1000 Daltons. Below is the typical amino acid analysis:

	Asp	Glu	Ser	Gly	His	Arg	Thr	Ala	Pro
Mole %	8.44	17.84	8.16	4.34	0.82	9.54	5.72	4.73	5.54

	Tyr	Val	Met	Trp	Ile	Leu	Phe	Lys	Cys
Mole %	4.03	5.37	0.73	0.40	3.81	9.29	3.23	3.25	5.16

Nomenclature:

INCI Name: Hydrolyzed Keratin
EINECS: 274-001-1
CAS: 69430-36-0

Toxicology:

In multiple pre-clinical trials there has been no observed toxicity of Cynatine® HNS. A FDA Acute Oral Toxicity Up and Down Procedure in Rats test has also been performed and showed no signs of toxicity up to 5g/Kg of body weight.

A full summary of the results from the toxicity portion of the pre-clinical trials as well as a full copy of the Acute Toxicity Test are available upon request.

Regulatory Status:

At the current time, Cynatine® is regulated as a dietary supplement under DSHEA and qualifies as such as it is regularly digested by humans in the normal food chain. For more information pertaining to the regulatory status of Cynatine® including in countries outside of the USA please contact us.

The addition of Cynatine® to a final product requires compliance with all applicable labeling procedures.

Recommended Labeling: Cynatine® HNS (Soluble Keratin)

Country of Origin: New Zealand

GMO Status: To the best of Roxlor's knowledge no genetically modified ingredients are used in the production of Roxlor products. A letter stating this is available by request.

These components may be placed in the ingredient listing in descending order of predominance by weight. Any mandatory nutrients should be listed in the Nutritional Facts Box.

Possible Structure/Function claims from Cynatine® HNS:

"Wrinkles and other signs of aging on the skin"
"Hair Loss associated with aging"
"Improves Hair Strength"

All labeling recommendations are subject to your company's regulatory officer's final approval.

Product and Nutritional Data:

Please reference the product Specification Sheets and Certificate of Analysis.
Note: Kosher Certificates are available upon request. (Not available as of 10/09)
Halal Certificate available upon request. (Not available as of 10/09)

Product Life:

Adhere to the optimal product usage date marked on each container. Powder product has a minimum shelf life of 24 months from date of manufacture when stored under recommended conditions.

Product Storage:

Must be stored in a cool, dry environment (59° F - 86°F, <60% Relative Humidity) and in

Typical Packaging Information:

Cynatine® HNS: 5Kg poly bag in box, 270Kg pallets

Keratec:

Keratec is a New Zealand-based biotechnology company producing new materials from natural sources using patented technologies. Its core technologies involve the extraction and purification of intact fractions of natural keratin proteins and lipids from wool sources. Keratec also designs and manufactures keratin-based materials for use as active ingredients in personal care and consumer health formulations and for biomaterial applications in the medical sector.

References:

Available upon request.

For More Information concerning Roxlor Products contact us:

Roxlor International, LLC
1013 Centre Rd. Suite 106
Wilmington, DE 19805
Phone: (302) 778-4166 Fax: (302) 999-8155
www.Roxlor.com
info@Roxlor.com