

Lanolin for Silky, Soft, Smooth, Skin

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The primary target for any skin care application product is the "Stratum Corneum" of our skin. We know that the "Stratum Corneum" is the most superficially placed dead epidermal cells without nuclei that are keratinised, with indistinct cell outlines. The "Stratum Corneum", covers the whole skin on the outside and is largely responsible in protecting the fragile interior of our body from potentially harmful and damaging stimuli present in the environment. It also helps in regulating body temperature, and controls the process of "Trans Epidermal Water Loss" (TEWL) from the body tissues. The cells of the "Stratum Corneum" are embedded in a multilamellar liquid crystal lipid structure called as the intercellular cement. It is not surprising that many of the skin care cosmetic products have lipids as one of the main components.

Lanolin has been used at levels ranging from 1% to almost 80% in cosmetic skin care products from olden times to enhance the moisture content of the skin, and soften it. Although petroleum jelly that complements lanolin in many cosmetic products is more effective in reducing TEWL from skin surface, lanolin and its derivatives are preferred as skin roughness is reduced in much larger scale than petroleum jelly. Anhydrous lanolin absorbs water and forms oil in water emulsion. It is also capable of losing water to the surrounding environment. In this manner, it allows a two-way transfer of water, which is not possible by use of petroleum jelly. Lanolin absorbs trans-epidermal water and penetrates the "Stratum Corneum" of human skin. It holds the water *in situ* behaving like a sponge regulating the water content of skin.

Chemically lanolin is a complex mixture of esters, free alcohols, and free fatty acids. Strictly speaking lanolin is a wax and not a fat as the mixed esters are not fatty glycerides, but derived from straight and branched chain aliphatic hydroxy acids and alcoholic compounds such as sterols, trimethyl sterols, straight chain and branched chain aliphatic diols. Lanolin is a mixture of esters and polyesters of 33 high molecular weight alcohols and 36 fatty acids. The alcohols are of three types: aliphatic alcohols, sterols, and tri-terpenoid, unsaturated nonhydroxylated acids and hydroxylated acids.

Sebaceous gland secretions of sheep are an oily substance called as crude wool wax. This wool wax is a complex chemical mixture secreted naturally by sheep to lubricate the wool and preserve its skin. The breed of the sheep, its diet, the geographical location and climate are all responsible for the quantity and quality of wool wax secreted by the animal. Lanolin is obtained after refining the scoured grease from

sheared sheep wool. In short, lanolin is extracted from sheep's wool. Firstly, the raw wool after shearing of the sheep is washed with a non-ionic surfactant like alkyl phenol ethoxylate or alcohol ethoxylate. In the olden times, it was washed with a mixture of soap and alkali. The scouring liquor is centrifuged to remove oxidised and other coloured compounds. The pale and less odorous grease separated is called the "neutral wool grease". The entire washing process of sheep wool is carried out in an alkaline pH. The free fatty acids present in grease reacts with the alkali to form soaps. These soaps are removed by treating them with acid solution to convert the soaps into their individual fatty acids. The treated mixture is separated out into two distinct layers — the impure lower and the purified upper layer of wool grease. The purified wool grease is washed thoroughly with water and all traces of mineral acid are removed.

The washed greases retain some fatty acids. These acids are removed by neutralisation with either sodium carbonate or sodium hydroxide solution. The fatty acid soaps formed are then extracted by use of an aqueous alcohol solution. The extracted soap in the alcoholic solution is again acidified with mineral acids and fatty acids separated. These fatty acids or wool grease fatty acids find use in many industrial applications.

The wool grease is washed again with water to remove any traces of residual soap or solvent. Lanolin thus obtained is dark coloured product. The colour is improved by bleaching with hydrogen peroxide, activated carbon, or absorbent clay. Additional processing like deodorisation by steam stripping under vacuum, liquid-liquid extraction, molecular distillation, with a further absorption bleaching are necessary to obtain a very highly purified pharmaceutical grade lanolin.

LANOLIN TYPES AND ITS DERIVATIVES

There are many different types and qualities of lanolin existing in the chemical market catering to different sections of the pharmaceutical, cosmetic, or other industry sectors. Some commonly available lanolin types are as described below.

Refined lanolin

It is a pale yellow solid having a melting point of about 40 degrees centigrade and a characteristic odour. It contains about 25 to 30% absorbed water. It is insoluble in water, but soluble in chloroform, or ether with separation of water. It has a high

proportion of high molecular weight straight chain acids and alcohol.

Anhydrous lanolin

It is yellowish tenacious semi-solid fat with a slight odour. It has a melting point of about 40 degrees centigrade. It is practically insoluble in water, but mixes with about twice its weight of water, without any separation. It is sparingly soluble in alcohol, freely soluble in benzene, acetone, ether, petroleum ether, etc.

Special grade solid lanolin

Special grades of solid lanolin are obtained when certain esters are removed by fractional crystallisation. This process enhances the emulsifying and stabilising properties of the product. It is useful in formulating products that are required to be stored at elevated temperature during use.

Lanolin is an excellent viscoelastic hypoallergenic moisturising emollient. Emolliency is defined as the ability of any product to enhance the moisture content of the skin, when applied. Lanolin is a wax having a remarkable property to smoothen and soften human skin, when used either alone or in combination with other cosmetic ingredients. It is observed that the emollient effect of lanolin lasts for about three weeks after application on the skin surface.

Lanolin is said to reduce the skin roughness by about 40% within one hour of application. Lanolin is well absorbed by the "Stratum Corneum" of human skin. It has a low comedogenicity. It is non-toxic, non-hazardous, and biodegradable. It has a low peroxide value and is usually stable to auto oxidation. Lanolin is compatible with the fatty substances of human skin including sebum. It is good water in oil emulsifier having an HLB of 4.

Lanolin is used in personal care products to reduce hypersensitivity and irritation caused by additive colorants, used in eye shadow, rouges, mascara, and by actives used in depilatory products. Lanolin is an auxiliary emulsifier in cold creams based on occlusive materials, like petroleum oils and waxes, by modifying the moisture permeability.

Lanolin acts as a binder and wetting agent in talcum powder by increasing the cling and emolliency. In hair care products it serves as a hair softener by preventing the drying, scaling, and brittleness of hairs. In pigmented products like lipstick, it helps in reduces sweating and cracking. Lanolin in nail varnish removers, shaving creams, or foams act as an emollient and as plasticizers in nail polishes. In soaps and detergents, lanolin acts as a super fattening agent and a skin emollient.

Liquid lanolin

Liquid lanolin is a pale yellow liquid obtained from highly purified normal lanolin solid by low temperature fractional crystallisation. Liquid lanolin has a very high proportion of low molecular weight branched aliphatic alcohol. It is available in different grades, commercially varying in their viscosity, pour, and cloud points. The most obvious advantage of liquid grade lanolin is the easy handling when compared to normal grades of lanolin.

Liquid lanolin's functions and usage are very similar to regular lanolin, although it has a much better spreading properties and is less occlusive. It is a very good water in oil emulsifier and is soluble in other oils used normally in cosmetic product preparations. It is possible to use liquid lanolin in higher concentrations to produce stable clear solutions.

Liquid lanolin has the same emollient effect as solid lanolin. It also has a very high skin affinity, penetrability, wetting ability and is substantive to skin. It gives a high degree of smoothness to skin and has a minimal "drag effect" or "friction effect". It is hypoallergenic, non-sensitising and non-irritant to skin.

Nowadays special types of lanolin liquids are available that are readily absorbed by human skin. This low viscosity liquid lanolin is usually derived from a mixture of straight chain alcohol acetates and lanolin alcohol. Exhibiting a very high water repellent property they are largely used in formulating water repellent baby oils, hair oils, sunscreen oils, colour pigment binding agents and face spreading cosmetic make ups.

Regular lanolin, liquid lanolin, lanolin alcohols on alkoxylation turns water soluble in nature. Water-soluble lanolin is pale yellow in colour and wax like in nature. They are very good emollients when used in cosmetic preparations. Water soluble ethoxylated lanolin alcohols are excellent solubilisers. They are mainly used in solubilising fragrances, vitamins, synthetic and natural oils that are other wise not very easily soluble in cosmetic base preparations.

Lanolin derivatives

Lanolin derivatives are obtained by ethoxylation or propoxylation of refined lanolin. These derivatives are soluble in aqueous alcohol mixtures. After-shave lotions, skin cleansers, wet tissues wipes, and other water-based applications are areas where these water and alcohol soluble lanolin are largely used. In hair sprays and hair styling gels apart from their emollient property, they additionally function as plasticisers.

Lanolin fatty alcohols

Lanolin fatty alcohols are brown to yellow brittle waxes primarily used as water-in-oil emulsifiers and emollients. They are obtained by alkaline saponification or by high-pressure hydrogenation of regular lanolin. Lanolin fatty alcohols are excellent emulsifiers when used at 2 to 3% incorporation levels in cosmetics. Lanolin fatty alcohols have a high proportion of over 30% free sterols like cholesterol, lanosterol, etc. Like lanolin it reduces insensible perspiration and is an excellent cost effective replacement for cholesterol in cosmetic preparations. It is also a very good natural moisturiser to protect human skin.

Lanolin alcohols are generally used in products like cosmetic creams, hair products, pharmaceutical creams, and ointments. Distilled lanolin alcohols are used for dispersing pigments and dyes in lipstick bases, as an emollient additive in oil in water and water in oil hair creams. Lanolin alcohols exhibit emolliency in nail polish, nail polish removers, by reducing the degreasing property of solvents in the formulation. Lanolin alcohols are used to control viscosity in shampoos and plasticise hair sprays. In soaps they improve the emulsifying properties and increase fine persistent lathers.

Lanolin fatty acids

As earlier mentioned, crude acids are generated in producing solid lanolin. The crude lanolin acid blends obtained are highly purified by molecular distillation to produce lanolin acids with lower colour and odour. The fatty acid mixtures of lanolin acids are soluble in ethyl alcohol, mineral oil, vegetable oil, oleic acid, and oleyl alcohol.

Lanolin fatty acids when added to hair gel, shampoos, etc impart sheen and soften the hair. They have little or no negative effect on shampoo performance. Lanolin fatty alcohol on neutralisation is used in shaving creams and in oil in water cosmetic emulsions as mild emollients.

Purified lanolin fatty acids when reacted with ethylene oxide produce non-ionic surfactants. The hydrophobic/hydrophilic balance and their properties in aqueous solution is directly dependent on the degree of ethoxylation. Lanolin non-ionic surfactant derivatives are used as cosmetic emulsifiers, wetting, and solubilising agents in cosmetic applications. Non-ionic surfactant lanolin derivatives are unstable in presence of high pH but are largely unaffected by electrolyte present in the formulae.

Lanolin esters

Lanolin ester range is obtained by esterification of lanolin fatty acids with isopropyl alcohol. The lanolin ester obtained

is purified by fractional distillation before use in cosmetic preparations. The three categories of lanolin derivatives available for use in formulations of personal care products are:

- * Low viscosity and low molecular weight, (Having a liquid nature),
- * Medium molecular weight, (Having a soft and butter like consistency) and,
- * High molecular weight, (Semi-solid)

Liquid ester derivatives have very good water resistance properties and are readily absorbed by human skin to give it a very smooth feeling. They are normally used in baby and skin care oil preparations.

The medium molecular weight derivatives readily become liquid when applied on skin. They are preferred in super fattening toilet soaps, cosmetic creams and lotions, talcum powders, etc.

The higher molecular weight semi-solid derivatives are non-greasy with good emollient and lubricating properties. They are largely used in lipstick for reducing the drag effect and in improving the gloss of the product.

Lanolin acids when esterified with glycerine produce a mixture of mono, di, and tri ester glycerides. Of the three types, when monoester is predominant with smaller amounts of di and tri esters then they are usually used as emulsifier's emollients in light creams and lotions. If higher proportion of di and tri is present with smaller amounts of mono ester glycerides, then the derivative not only has a very good emulsifying and emollient property, but also leave a heavy hydrophobic non greasy film on skin. This film formed on skin can be easily washed off, due to its poor resistance with soap and detergents.

Acetylated lanolin

Acetylated lanolin is an almost odourless semi-solid, yellow coloured unctuous mass having a melting point of 36 degrees centigrade. It is soluble in mineral and some vegetable oils. Acetylated lanolin is easily dispersed in oil in water emulsion. It does not form water-in-oil emulsion and is used as an aid in pharmaceutical ointment preparations.

Lanolin and its various derivatives are considered as safe and effective, ingredients suitable for use in product applications not only for use in skin care cosmetics, but also hair care formulae and toiletries. Besides excellent moisturising and emollient properties, lanolin reduces trans-epidermal water loss by about 32% maintaining the skin in a healthy condition soft and silky smooth.