Shea butter with improved moisturisation properties

Shea butter has recently become a very popular ingredient in cosmetics and personal care applications due to its good emolliency and moisturising properties.

The high content of unsaponifiable lipids, especially triterpene cinnamates, contributes to skin healing and restoration by anti-inflammatory action. Shea butter in all its forms is also easy to formulate with, especially if one of the butters specifically developed for cosmetic applications is used. All in all, this indicates that shea butter is both a functional and marketable ingredient with a long history of safe use in cosmetics and explains well its popularity in modern skin care.

With new developments such as Lipex Sheasoft from AAK, the formulation opportunities are better than ever.

The shea tree, or karité tree, on the savannah in Burkina Faso.

Shea butter is available in many forms

Shea butter is obtained from the kernels of the shea tree (also known as the karité tree) which grows in the semi-arid savannah of sub-Saharan Africa. The shea butter trade is a very important factor for the economy of the communities in this area and has a long history as a source for edible fat and for skin treatments. The original shea butter is a yellowish paste with a characteristic odour and refining is normally required to produce an ingredient for cosmetic use. The shea butter can be further processed into a variety of ingredients with improved functionality and today a large range of shea butters for cosmetic use is available. Properties such as the melting point and melting profile, as well as the content of unsaponifiable matter, can be optimised to meet requirements for different applications.

Liquid shea butter is ideal for light formulations and for cold processing while semi-solid butters are better suited for heavier formulations and for fine-tuning the consistency of the formulation. The selection of a shea butter ingredient in a formulation usually depends on the type of formulation, its desired sensory profile and the positioning of the formula in the market.

Triglycerides and triterpene esters – main constituents of shea butter

Shea butter, in common with most other vegetable oils and fats, are triglycerides (esters of glycerol and fatty acids). However, shea butter also contains very high levels of non-glyceride components, normally summarised by the collective term "unsaponifiables" or "unsaponifiable matter". A typical vegetable oil contains less than 1% of unsaponifiables, mainly phytosterols and tocopherols. In contrast, shea butter can contain as much as 7% to 10% of unsaponifiable matter, comprising, among other components, triterpene alcohols esterified to cinnamic acid, acetic acid and long chain fatty acids. On the other hand, the content of tocopherols in shea butter is comparatively low, often about 100 ppm, corresponding to a low level of sensitive polyunsaturated fatty acids in the fat. The main shea butter fatty acids, oleic and stearic acid, are sufficiently stable against oxidation without the aid of tocopherol.

Melting profiles determine consistency and heat stability

The physicochemical properties of vegetable oils and fats are generally given by the fatty acid composition of the constituent triglycerides. Longer fatty acid chain lengths increase melting points while increased unsaturation give lower melting substances. As all vegetable oils and butters are composed of many different triglycerides, a single melting point can normally not be given. Instead the melting

Table 1: Composition of shea butters.

		Lipex Sheasoft	Refined shea butter
Palmitic acid	(%)	4-5	3-5
Stearic acid	(%)	41-43	41-45
Oleic acid	(%)	44-45	43-45
Linoleic acid	(%)	6-8	5-7
Tocopherols	(ppm)	<100	<100
Unsaponifiable matter	(%)	5-8	2-8

profile, given as the percentage solid fat at each temperature, is used to characterise semi-solid fats, including shea butter.

A traditional shea butter melts at body temperature and is completely melted at temperatures above 40˚C. This means that there are no shea butter solids remaining to stabilise a formulation at this temperature. At room temperature, pure shea butter can be fairly hard, especially if stored under non-optimal conditions. Traditional shea butter also requires a good temperature control when the formulation is cooled, especially if the shea butter content in the formulation exceeds 2% to 3%. If the cooling process is not carefully controlled, there is a risk that the formulation develops large crystals on the surface, a phenomenon known as "bloom".

Lipex Sheasoft, referred to subsequently as the advanced shea butter, was developed to improve the heat stability of body butters and lip treatments. It has a comparably high solids content at 40˚C to 45˚C, stabilising the formulation at these temperatures. At the same time, the solids content at 25˚C to 35˚C is low, making a soft and plastic material with good spreadability and good skin softening properties. The skin feel of the advanced shea butter is perceived as dryer and richer compared to traditional shea butter due to the elevated solids content at body temperature.

The advanced shea butter also solidifies rapidly and stabilises in the desired beta crystal form very rapidly compared to other shea butters. This makes the manufacturing process easy and gives long shelf life to formulations without the risk of bloom or changes in consistency and visual appearance over time.

No rancidity

All Lipex shea butters are refined and deodorised in order to remove pro-oxidative contaminants and precursors of rancidity. The oxidative stability of the advanced shea butter focused on in this article is reasonably high as the level of polyunsaturated fatty acids is low in shea butter. The Oxidative Stability Index is around 20 hours at 110˚C, indicating a shelf life of more than 2 years in a formulation without rancidity and odour development.

Anti-inflammatory and skin repair action from shea butter triterpene esters

The content of bioactive triterpene esters in shea butter varies between 2% to 7% depending on the origin and the quality of the shea kernels, and the initial content can also be increased by different processes such as solvent fractionation or molecular distillation. Shea butters with elevated levels of triterpene esters possess anti-inflammatory and fibroblast proliferating properties, shown in *in vitro* skin models. In the advanced shea butter, the triterpene esters normally vary between 5% to 7% which is slightly higher than in the traditional refined shea butters.

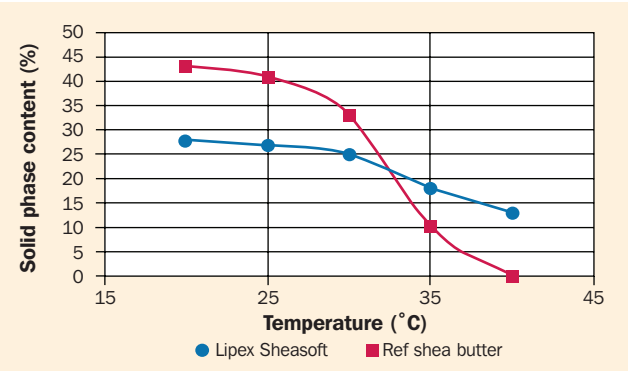

Figure 1: *Melting profile of traditional shea butter versus Lipex Sheasoft.*

Verifying moisturising properties

The moisturising properties of the advanced shea butter have recently been evaluated in a pilot study. The aim of the study was to investigate whether shea butter had any benefits over a conventional emollient in short-term moisturisation on skin which has been challenged by intense washing. Frequent washing is common today and repeated removal of the superficial skin lipids can lead to increased stress on the skin resulting in increased trans-epidermal water loss and lower moisture content in the skin. A rapid re-lipidisation and re-moisturisation is then desired and application of a suitable skin care cream or lotion is recommendable to help the skin recover from the challenge. However, emollients are expected to give different degrees of moisturisation, and build up the moisture barrier in different ways as they vary in polarity and solubilising power due to variations in their chemistry. Emollients also tend to interact differently with both other ingredients in the formulation as well as skin constituents.

To carry out the pilot moisturisation study, 10 women aged between 22 and 56 were recruited from laboratory and office staff. Three areas of 3 cm x 5 cm were marked on the left inner forearm of each test person and washed by swabbing with ethanol. The three areas were randomised for the three different treatments: A – shea butter, B – hydrocarbon emollient and C – no emollient. The shea butter in this study was Lipex Sheasoft and the hydrocarbon emollient was isohexadecane. All emollients were applied neat, without additives, emulsifiers or solvents.

Immediately after the ethanol had evaporated, 4 mg to 5 mg of emollient was applied to the test area and rubbed gently into the skin, covering the test area as completely as possible. The test areas were to be kept open and free of clothing over the test period. The subjects were called for measurement of the transepidermal water loss and skin

Table 2: Body lotion

Trade name	INCI name	Content (%)
Lipex Sheasoft	*Butyrospermum parkii*	3.0
Lipex 205	*Butyrospermum parkii*	5.0
Lipex L'sens	Soybean glycerides (and) *Butyrospermum parkii* butter unsaponifiables	3.0
Akomed R	Caprylic/capric triglycerides	5.0
Akoline PG 7	Polyglyceryl-3 stearate	3.5
Akoline MD50	Glyceryl stearate	1.0
Akoline SL	Sodium stearoyl lactylate	0.2
	Glycerin	5.0
	Xanthan gum	0.1
	Preservative and perfume	q.s.
Water	Aqua	To 100
NaOH 20% in water		To pH 6.5

This body lotion combines Lipex Sheasoft with a liquid shea butter and caprylic/capric triglycerides to produce an easily absorbed and soft lotion. Lipex L'sens increases moisturisation by binding water in liquid crystals together with the natural emulsifiers in the Akoline range.

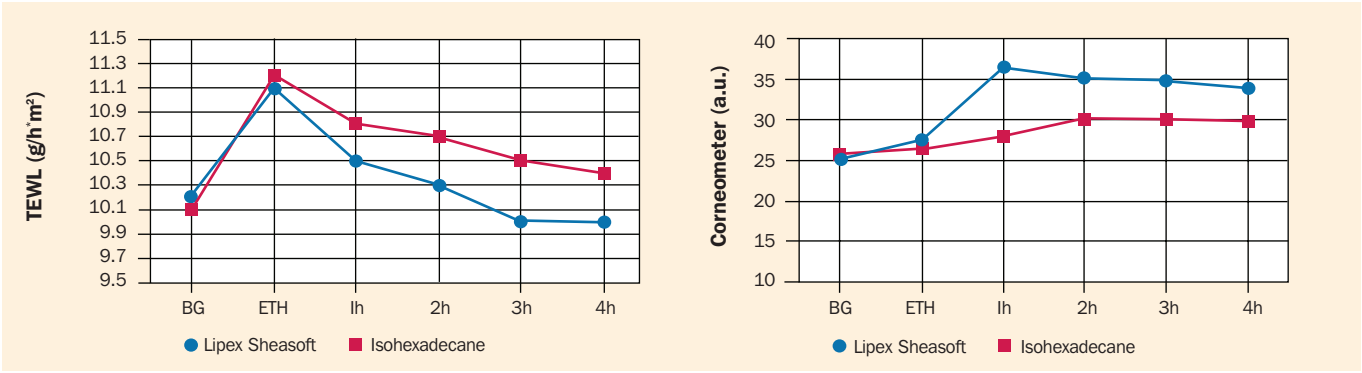

Figure 2: *TEWL and Corneometer results.*

moisturisation in the treated areas once per hour for 4 hours after the application. Background measurements were made on the test areas before and after washing with ethanol.

A Courage+Khazaka MPA 5 system equipped with Tewameter 300 and Corneometer CM 825 probes was used for all evaluations. Readings were taken until a stable signal was obtained and the average of minimum 20 readings were used as the measured value.

The data were checked for consistency and outliers before the means of transepidermal water loss and corneometer values were calculated.

The results show that ethanol washing, as expected, immediately increases the trans-epidermal water loss of the treated areas. In areas treated with the advanced shea butter, the trans-epidermal water loss is restored to the starting values after about two hours after application. A strengthening of the moisture barrier is observed after 3 to 4 hours, observed as further decreasing trans-epidermal water loss values. In comparison, the isohexadecane did not give the rapid trans-epidermal water loss recovery observed with the shea butter and still after 4 hours the values were higher than the starting TEWL.

A similar effect was seen in the skin moisture measurements. A non-repeated ethanol washing does not influence the immediate corneometer values as the washing does not change the water content in the layer sensitive to corneometer measurements. Again the two tested emollients gave different results. Application of the advanced shea butter gives an increase in the skin moisture already at the first measurement 1 hour after application and the effect is persistent over the 4 hour test period. The isohexadecane did not give any increase in the corneometer values, acting more as an emollient and less as moisturiser.

The difference observed between the two tested emollients shows that the molecular structure and the physicochemical properties of individual emollients will have a strong influence on the moisturising properties of a formulation. When formulating a skin care cream, both aesthetics, as well as moisturisation and emolliency, must be optimised and here the advanced shea butter offers an ingredient with many possibilities.

Applications in formulating

Shea butters have traditionally been used in skin care creams and lotions as bases for body butters and as ingredients in sunscreen and after-sun products. With its higher melting point and semi-solid consistency, the advanced shea butter is ideal for formulating heavier creams, lotions and butters but it can also be applied to make lip balms and other anhydrous formulations.

Table 3: Lip balm.

Trade name	INCI name	Content (%)
Lipex Sheasoft	*Butyrospermum parkii*	27.0
Lipex Shea	*Butyrospermum parkii*	8.0
Akorex L	Canola oil	49.8
Lipex Omega 3/6	Olus oil (and) *Camelina sativa* seed oil	5.0
	Beeswax	5.0
Akoline PGPR	Polyglyceryl-3 polyricinoleate	5.0
	Essential oil	0.2

This lip balm formulation combines two shea butters in an optimal blend for softening the lips and has a consistency suitable for packaging in a tube. Akorex L and Lipex Omega 3/6 give soothing and protecting effects from high levels of vitamin E, omega-3 and omega-6 fatty acids. Akoline PGPR adds shine and binds moisture.

Lipex Sheasoft is recommended to be used in concentrations starting at 1% in any type of emulsion product in combination with other emollients. Added at 2% to 3% of the formulation the effects of the higher melting point and higher solids content start to influence both formulation consistency and skin feel. If further high temperature stability is desired, concentrations up to 5% to 10% can be used. Lipex Sheasoft combines well with other emollients, especially esters and vegetable oils. A polar emollient with low viscosity, such as a branched chain ester, can be used to increase the spreading and skin absorption if a lighter formulation is desired. Using a combination of Lipex Sheasoft and the liquid shea butter Lipex 205 makes it possible to optimise the shea butter content and skin feel of the formulation.

Anhydrous formulations such as lip balms can be made from starting with Lipex Sheasoft in combinations with natural waxes and liquid emollients. Formulations with high shea butter content need to be force-cooled to a final product temperature of 22˚C to 24˚C for optimal stability.

The lip balm formulation shown in Table 3 combines Lipex Sheasoft with Lipex Shea as the base for the formulation. Beeswax is used to start the solidification and to further increase the high temperature stability. Other natural waxes such as carnauba or candelilla can be exchanged for beeswax as they also have good compatibility with Lipex Sheasoft.

Conclusion

Lipex Sheasoft is a unique shea butter for unique formulations. It has a proven immediate moisturisation and skin barrier enhancing effect, making it an ideal emollient for a variety of applications within advanced skin care.

The soft consistency, combined with a high melting point, offers the formulator many ways to optimise both skin feel and high temperature stability – without compromising long shelf life and attractive appearance. PC