Technical Bulletin
AarhusKarlshamn
Lipids for Care




Lipex® Shea Butter Family

Natural Vegetable Functional

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Introduction

Lipex® Shea Butter Family is the name given to a range of cosmetic ingredients developed over the years by AarhusKarlshamn. Starting from standard shea butter, a range of ingredients is now available, covering the majority of possible application areas within skin care and hair care.

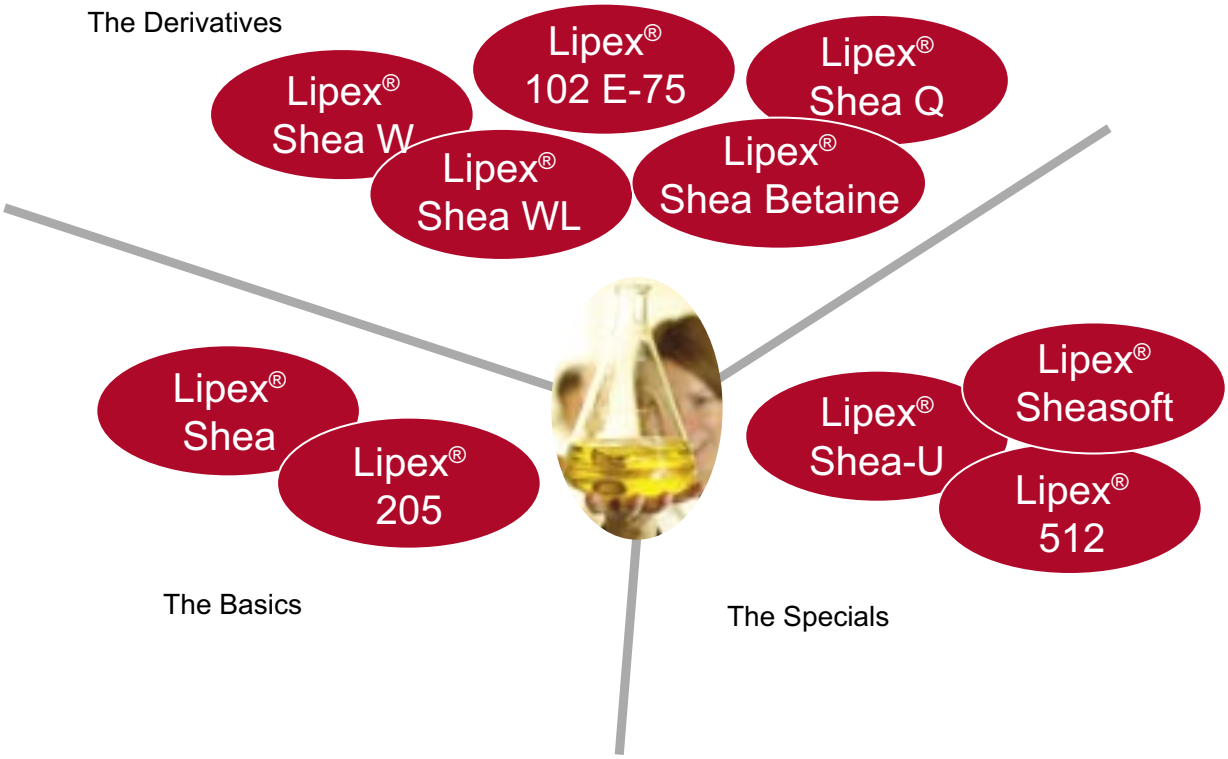
AarhusKarlshamn continuously develops the knowledge and applicability of the shea butter range for cosmetic uses, keeping full control of the quality and availability, starting with the harvesting of the kernels in West Africa, to the state-of-art processing facilities in Sweden and Denmark.

This technical bulletin describes first the Lipex® Shea Butter Family product range and continues then to describe the origin and processing of the materials. The unique composition of shea butter is described next, followed by a description of the bioactive properties given by the triterpene alcohol esters found in the shea. The bulletin finishes with a summary of the uses and applications for shea butters in cosmetics and personal care.

Product range

The Lipex® Shea Butter Family comprises three groups of products (figure 1), each group having their distinct characteristics and uses. The basic shea butters can often fill all the needs of the formulator while the speciality shea butters often come in to solve specific problems. Finally, the shea butter derivatives extend the use of shea butters into non-traditional applications by offering shea ingredients with altered functionality such as water solubility or surface activity. The shea butter derivatives are extensively described in a separate technical bulletin (“The Lipex® Shea Butter derivatives”). Table 1 summarises the main properties of the products in the Lipex® Shea Butter Family.

Figure 1: Lipex® Shea Butter Family



Basic shea butters

Lipex® 102
The classic, standard refined shea butter is still a popular ingredient when no specific demands are made on the physical properties or unsaponifiable content. Lipex® 102 fulfils the strict quality requirements of all Lipex® ingredients and has shown a high and consistent quality over the years. It has the typical shea butter skin feel and moisturising properties but needs some extra care in formulating and processing, especially if used at higher concentrations.

Lipex® Shea – semi-solid shea butter
Lipex® Shea is the basic semi-solid shea butter that is most suitable for use in all types of skin care applications where a substantial amount of shea butter is desired in the formulation. It has a simple crystallisation behaviour and high stability against bloom and hardening during storage. The semi-solid consistency gives good sensory properties with the typical shea butter skin feel and high moisturising effect. The content of unsaponifiables is typically 7-8% of the triterpene ester type.

Lipex® 205 – liquid shea butter
The liquid shea butter, Lipex® 205, is a good choice when a liquid emollient is needed in the formulation. It delivers the skin care benefits of the traditional shea butter having a high content of unsaponifiables (7-8% triterpene esters). Being a liquid material, it is easy to incorporate into most types of formulations and is easy to handle in production.

Speciality shea butters

Lipex® Sheasoft – high-melting shea butter
Lipex® Sheasoft combines a high melting point with a soft consistency at room temperature. This combination of properties makes Lipex® Sheasoft an ideal ingredient for both emulsified and anhydrous body butters, balms and night creams. It has high, long-lasting moisturising action with a soft, dryish skin feel. Lipex® Sheasoft crystallises readily into the stable beta modification, making it easily processed and resulting in robust formulations.
Lipex® 512 – hard shea butter
Lipex® 512 is a hydrogenated shea butter that has higher solids content over the temperature range. This feature can be used when the consistency of the formulation needs to be made firmer at room and body temperature.

Lipex® Shea-U – bioactive shea butter
Lipex® Shea-U is a semi-liquid shea butter with high concentration of the bioactive triterpene esters that are the characteristic components of the shea butter unsaponifiable. The unsaponifiable content is about 20%, consisting mainly of cinnamic and fatty acid esters of triterpene alcohols. Lipex® Shea-U is has anti-inflammatory properties shown in vitro as well as a stimulating effect on fibroblast proliferation, both contributing to the skin healing effects traditionally attributed to shea butter. Lipex® Shea-U is easily incorporated into skin care emulsions and balms due to its liquid character, usually at levels between 0.2-1.0%. Lipex® Shea-U is obtained through a patented fractionation technique (Alander et al (1)).

Shea butter derivatives

Lipex® Shea W – solid shea wax
Lipex® Shea W is a solid wax ester derived from shea butter and cetyl alcohol. It has a melting point around 43-47 °C and a simple crystallisation behaviour, making it suitable for many applications in skin care, colour cosmetics and hair treatments.

Lipex® Shea WL – liquid shea wax
Lipex® Shea WL is a liquid wax ester derived from oleyl alcohol and shea butter. It has a drier skin feel than the liquid shea butter (Lipex® 205), making it suitable for high end skin care formulations and for products intended for oily skin.

Lipex® 102 E-75 – water-dispersible shea butter
Lipex® 102 E-75 is a highly ethoxylated shea butter derivative, suitable for use in shampoos and shower gels. It increases the viscosity of the formulation and reduces the irritancy of anionic surfactants. It is also suited for clear formulations. Normal use ranges between 1-4%.

Lipex® Shea Betaine – cleansing shea butter derivative
Lipex® Shea Betaine extends the use of shea butter into hair and body care products as a complement to the traditional cocamidopropylbetaines. It has good foaming power and acts as a viscosity builder in shampoos and shower gels.

Lipex® Shea Q – cationic shea butter surfactant
Lipex® Shea Q is a quaternary ammonium surfactant with good substantivity to hair and skin, acting as a conditioning and anti-static agent in hair conditioners, masks and balms. It increases the gloss of the hair and improves both wet and dry combing properties.

Table 1: Lipex® Shea Butter Family – summary of properties

Product	Description	INCI name	Appearance	Unsaponifiable content
Lipex® 102	Refined standard shea butter	Butyrospermum parkii (EU) Butyrospermum parkii (Shea Butter) (US)	White-pale yellow solid, mp 32-34 °C	2-4 % triterpene esters 2-4 % hydrocarbons
Lipex® Shea	Semi-solid basic shea butter		White solid, mp 32-34 °C	7-8 % triterpene esters
Lipex® 205	Liquid basic shea butter		Yellow liquid oil	7-8 % triterpene esters
Lipex® Sheasoft	High-melting shea butter		White solid, mp 50-54 °C	2-4 % triterpene esters
Lipex® 512	Hard shea butter		White solid, mp 32-34 °C	7-8 % triterpene esters
Lipex® Shea-U	Bioactive shea butter		Yellow, viscous liquid	20-24 % triterpene esters
Lipex® 102 E-75	Water-dispersible shea butter	PEG-75 shea butter glycerides	White, waxy solid, dispersible/soluble in water	< 1%
Lipex® Shea W	Solid shea wax	Shea Butter Cetyl Esters	White solid, mp 43-47 °C	~ 4 %
Lipex® Shea WL	Liquid shea wax	Shea Butter Oleyl Esters	Yellow liquid	~ 4 %
Lipex® Shea Betaine	Cleansing shea butter betaine	Shea Butteramido-propyl Betaine		< 1%
Lipex® Shea Q	Cationic shea butter surfactant	Shea Butteramido-propyltrimonium Chloride		< 1%

Shea butter – origin and processing

Shea butter is obtained from the kernels of the shea tree, Vitellaria paradoxa (botanical synonym Butyrospermum parkii, which is also the currently adopted INCI name for shea butter). The trees grow in the semi-arid savannah woodland of western Africa, ranging from Senegal to Uganda. The main shea producing countries include Benin, Ghana, Nigeria, Burkina Faso and Ivory Coast.

The shea tree flowers typically in January-March with cream-white flowers on leafless branches from dormant buds. The fruit matures in four-six months after flowering with harvesting taking place in June-September. The shea trees need to reach an age of 10-25 years before they start to bear fruit. Unless destroyed by fire, drought or human activities, the trees may live for 200 years.

The shea fruit is a 4-8 cm ellipsoidal berry, containing the hard-shelled seed (nut) enclosing a soft kernel with oil content of 40-60%. After the shea fruits are harvested, the fruit flesh is removed by fermentation or boiling. After drying, the nuts are cracked open and the kernel is removed. The oil can be extracted from the kernels in different ways. Traditionally the kernels have been crushed and immersed in hot water; the oil is skimmed off from the surface and subsequently purified and packaged to make shea butter. Industrially the oil can be extracted by solvents or by pressing.

The Lipex® Shea Butters are made from crude shea butter that has been alkali refined to remove phospholipids and free fatty acids, followed by bleaching with a clay mineral to remove pigments. The final step before packaging is always deodorisation, a process utilising steam at low pressure to remove volatile components that give rise to undesired flavours. Some of the Lipex® Shea Butters are made from shea butter fractions, obtained by low temperature fractionation in acetone. The processing steps used in making Lipex® Shea Butters efficiently remove all contaminants from the oil while still preserving the content of unsaponifiables (triterpene alcohols, phytosterols and tocopherols). Contaminants that are removed are for example metals from the soil and processing equipment, polyaromatic hydrocarbons from environmental pollution and solvent residues from the extraction and processing.

Shea butter – composition

Shea butter is unique in its composition compared to other vegetable oils. The main component in shea butter – the triglycerides derived from oleic and stearic acid – is divided into two fractions, one low-melting with primarily StOO (stearic-oleic-oleic) and one higher-melting fraction comprising mainly St-O-St (stearic-oleic-stearic). The latter fraction is desired as a component for making cocoa butter equivalents for the chocolate and confectionery industry due to its similarity with cocoa butter triglycerides (mainly St-O-St, P-O-P and P-O-St, P being palmitic acid). The fatty acid pattern of shea butter reflects the dominating triglycerides (table 2).

Table 2: Typical fatty acid and triglyceride compositions of shea butters

Fatty acids	Lipex® 102	Lipex® 205
P - C16:0 – palmitic acid	3-4	4-5
St - C18:0 – stearic acid	42-44	22-25
O - C18:1 – oleic acid	43-45	55-60
L - C18:2 – linoleic acid	5-6	7-9
Others	1-7	1- 12

The other peculiarity of shea butter is its high content of unsaponifiable matter. Most vegetable oils contain less than 1 % of unsaponifiable matter, mainly Vitamin E (tocopherols) and phytosterols such as beta-sitosterol. Shea butter, in contrast, can contain between 4-10% of unsaponifiables, divided into several substance classes. About half of the unsaponifiable matter is poly-unsaturated isoprenoidal hydrocarbons with gummy appearance (karitenes). This unsaponifiable fraction is usually undesired due to its high degree of unsaturation, leading to oxidative sensitivity and is normally removed in the Lipex® Shea Butters. The rest of the unsaponifiable matter is mainly composed of triterpene esters (table 3). The triterpene alcohols are high melting (210-240 °C) substances, which in the shea butter are esterified to cinnamic acid or to fatty acids. The unsaponifiables also comprise low amounts of tocopherols (Vitamin E) and phytosterols. In contrast to other vegetable oils, the dominating phytosterols in shea butter are alpha-spinasterol and delta-7-avenanasterol rather than beta-sitosterol.

Table 3. Triterpene alcohols in shea butter unsaponifiables

	Content in triterpene fraction (% w/w)
Alpha-amyrin	39
Beta-amyrin	4
Lupeol	16
Butyrospermol	27
Parkeol	3
Psi-taraxasterol	5
Unidentified	6

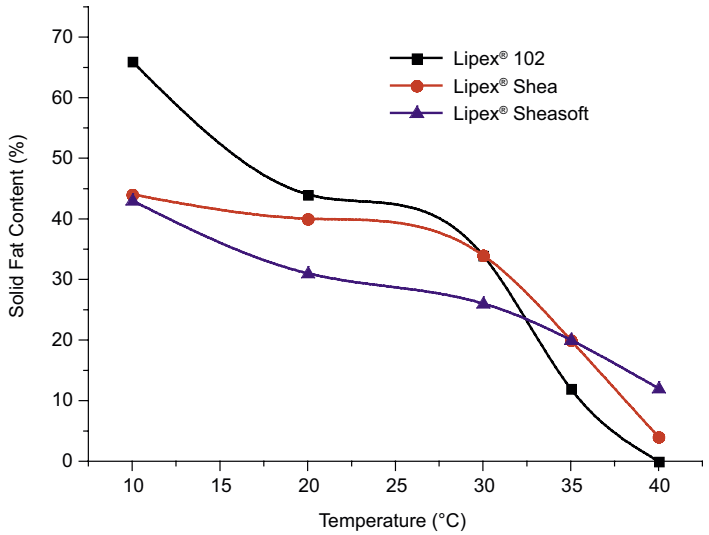
Shea butter – physicochemical properties

Traditional shea butter is a semi-solid fat due to its composition of a liquid triglyceride in combination with a high-melting triglyceride. The consistency of vegetable fats is normally well described by the “Solid Fat Content” at different temperatures. It is measured by differential scanning calorimetry (indirect method) or by low resolution pulsed NMR (direct method) and expressed as the percentage of solids remaining at different temperatures.

The solid fat content curve of traditional shea butter is compared to some of the Lipex® Shea Butters in Figure 2. The SFC curves can be used to optimise the consistency and stability of the formulation at different temperatures. A product with more than 50 % of solids is perceived as a hard, waxy solid. If the solids content goes below 10 % the product normally collapses, separating the solids and the liquid. A product between 10-50 % of solids usually has good spreadability and high stability against sedimentation, making this range interesting for skin care applications. The following guidelines can serve as a starting point for selecting shea butters and formulating:

- total solids between 30-50 % at 20-25 °C gives a soft and spreadable product
- total solids around 25-35 % at body temperature (32-35 °C) gives a good skin feel
- total solids above 10% at highest storage temperature (for example 45 °C) gives good stability during high temperature storage

Figure 2: Melting profiles for semi-solid shea butters



With this scheme in mind, different ingredients can be mixed to optimise the behaviour of the formulation.

The dominating solid triglycerides in shea butter crystallise normally in one of three different polymorphs. The lowest melting – alpha - form, melts around 14-16 °C. Its stability is low, transforming in about 30 minutes completely to the intermediate-melting beta-prime or the high-melting beta form. The beta-prime form in shea butter melts at around 18-24 °C, and its stability is normally measured in hours. The stable, high-melting beta form melting at 32-34 °C forms gradually over a period of 2-4 days unless the shea butter is tempered using temperature cycling and high shear processing.

Failing to obtain the desired, stable beta form in shea butter during the manufacturing process leads to stability problems in the form of “bloom” and consistency changes on storage. This problem has previously limited the possibility to make formulations with high levels of shea butter. With the development of Lipex® Shea, Lipex® 512 and Lipex® Sheasoft, these problems have more or less been eliminated and many examples of emulsions and anhydrous products with high shea butter contents are now available. In these products the rate of transformation from the unstable alpha- and beta-prime forms has been accelerated and the beta form is now obtained in 3-6 hours. This increase in stabilisation has lead to an increase in storage stability and solving the bloom problem.

Bioactivity of shea butter

There are several reasons for using shea butter and its fractions in cosmetic and personal care products. First of all, the semisolid character of traditional non-fractionated shea butter gives a buttery consistency and easy spreadability on the skin. The high emolliency (skin softening effect) of this semi-solid material is also appreciated. In some cases the use of liquid shea butter fractions is preferred since a liquid oil is more easily formulated into a skin care creme or even into surfactant based products such as shower gels, bath oils and hair conditioners. In common with other vegetable oils and fats, shea butter and its fractions are good moisturisers, preserving and increasing the moisture content of the skin.

Although the moisturising properties and skin feel of shea butter are good, they are not very unique compared to other vegetable oils and fats with similar fatty acid composition and consistency. The main reason for the use of shea butter in high-end cosmetic formulations is rather associated with the non-glyceride components, primarily the triterpene alcohol esters, due to their bioactive properties.

Skin aging

Free radicals are closely linked with aging and oxidative stress in the skin, since the combination of UV radiation and access of oxygen when staying outdoors creates a lot of free radicals in the outer layers of the skin. Free radicals are associated not only with decreased cell viability and DNA damage but they are also a significant part of the skin ageing process when the skin loses its elasticity and regenerative power. It is therefor essential to protect the skin against the effects of UV-radiation and oxygen derived free radicals and many formulation strategies to achieve this have been developed during the past decades. Among the first uses of shea butter in cosmetic applications were sunscreen and sun care products where the UV-absorbing ability of the cinnamic acid esters of the triterpene alcohols were said to act synergistically with the added commercial sunscreens. However, the actual UV-absorbing capacity of shea butter is too weak in this sense, and even high amounts of shea butter in a formulation do not significantly alter the Sun Protection Factor (SPF) of a formulation. A double-fractionated liquid shea butter fraction with approximately 20% triterpene esters has a SPF of 3-4, which is an order of magnitude too low to give any effect at reasonable concentrations in a formulation.

Another aspect of the exposure to UV-radiation and external pollutants is the initiation of different types of inflammatory reactions as a response to the external challenge. The inflammatory reactions in the living organisms are part of the natural defence systems, with the purpose of eliminating harmful substances or micro-organisms before major damage to the organisms occurs. Sometimes these defence mechanisms run out of control and adverse inflammatory reactions lead to diseases like allergy, asthma and rheumatoid arthritis. In such cases, anti-inflammatory substances can be administered to change the course of the inflammatory reaction or to inhibit it completely. Several classes of anti-inflammatory drugs are available but they are often associated with adverse effects. The absence of serious side effects from phytosterols and triterpene alcohols in combination with a significant anti-inflammatory action has made them interesting as alternatives to synthetic drugs.

Bioactivity of triterpene alcohols and esters

The literature abounds with bioactivity studies made with the triterpene alcohols found in shea butter but unfortunately very few published studies exist on shea butter itself and its enriched fractions. However, the studies performed on the major shea butter triterpene alcohols indicate that there are at least two areas where interesting bioactive effects from shea butter can be expected. The anti-inflammatory effects of phytosterols, including the triterpene alcohols, are well demonstrated for both the free alcohols and the esters. The second effect is associated with the synthesis and degradation of the structural proteins collagen and elastin.

Most of the individual triterpene alcohols found in shea butter have been investigated for their anti-inflammatory properties. Several studies show that amyrins as well as lupeol and butyrospermol are anti-inflammatory in different types of inflammatory models. For example, Akihisa et al (2) presented data on the anti-inflammatory effect of a large number of triterpene alcohols found in Theaceae oils (Camellia and Sasanqua), including butyrospermol, lupeol, alpha- and beta-amyrin as well as taraxasterol, psi-taraxasterol and 24-methylenedammarenol (all of them also found in shea butter). All of these triterpene alcohols (in the form of free alcohols) showed inhibitory activities in the same concentration range as the control substance indomethacin, when tested in an inflammation model in mice. The mechanism for the inflammatory action of lupeol and its esters was investigated by Fernandez et al (3). The anti-inflammatory activity of lupeol was studied in models demonstrating effects on two different inflammatory pathways. Topically applied lupeol had a significant anti-inflammatory effect in the TPA model (cyclooxygenase pathway) while the effect was less pronounced in the arachidonic acid induced oedema (lipoxygenase pathway), only the highest concentration tested gave any significant effect. It was concluded that lupeol is an inhibitor of certain pro-inflammatory mediators such as prostaglandin E2 (cyclooxygenase metabolite) and cytokines but not leukotrienes (lipoxygenase metabolites).

Some of the triterpene alcohols found in shea butter are also inhibitors of protein degrading enzymes, proteases. Different types of proteases are active in the skin, degrading collagen and elastin, two of the major structural proteins contributing to the toughness and strength of the skin. The production of collagen and elastin decreases with increasing age, resulting in thinner and less elastic skin. The effects of this natural aging process can be alleviated by stimulating collagen and elastin synthesis or by inhibiting the activity of the collagenases and elastases. Proteases are also implicated in the breakdown of connective tissue in rheumatoid arthritis and the triterpene alcohols and their derivatives have been investigated as alternatives to conventional pharmaceutical products such as hydrocortisone and indomethacin.

Several studies have been conducted to evaluate the inhibitory effect of triterpene alcohols on different types of proteases. For example Hodges et al (4) showed that lupeol and its palmitate and linoleate were inhibitors of trypsin activity while no effect on porcine pancreatic elastase was observed. Metalloproteases (for example collagenase) and serine proteases (trypsin, chymotrypsin, porcine pancreatic elastase, human leukocyte elastase) are inhibited in vitro by various types of triterpenes, including lupeol and its esters. Rajic et al (5) showed that esterification increases the

degree of inhibition of trypsin and chymotrypsin. Lupeol palmitate, lupeol linoleate and alpha-amyrin linoleate were potent trypsin inhibitors while free lupeol and alpha-amyrin were less efficient. Chymotrypsin was inhibited by lupeol, the other tested compounds being weaker inhibitors. These examples show that there is a potentially useful effect of the triterpene alcohols from shea butter to prevent aging effects on the skin by inhibiting the degrading activity of proteases.

Bioactivity testing of Lipex® Shea-U

This combination of an anti-inflammatory action with the protease inhibiting effects from the triterpene alcohol esters can be utilised when formulating high-performance skin care products such as sunscreens and sun care articles with shea butter. The anti-inflammatory effect of Lipex® Shea-U with about 25% unsaponifiables was investigated in vitro using cultured human epidermal keratinocytes (Bio-HC, Pessac, France). The unsaponifiables were included at 0.5 - 5.0 mg/m l in the culture medium and the cells were allowed to grow for 48 hours. 20 microg/ml of croton oil, a non-sensitising irritant, was added. The concentrations of IL 1-alpha in the cell lysates were determined after 24 hours incubation by ELISA. Hydrocortisone 21-hemisuccinate sodium in concentrations between 0.1 - 1 mg/ml was used as a positive control.

The anti-inflammatory properties of the shea butter unsaponifiable fraction are shown in Table 4. The anti-inflammatory activity is calculated from the IL 1-alpha contents before and after croton oil treatment corrected for the basal cytokine content. The anti-inflammatory effect of the shea butter unsaponifiables is independent of the tested concentration, indicating that the effect is limited by the bio-availability of the strongly lipophilic triterpene esters. The anti-inflammatory effect can therefore be enhanced by suitable formulations. Based on the in vitro test data it is expected that inclusion of 0.1-0.5% in a formulation of the shea butter unsaponifiable fraction can be recommended.

The effect of the shea unsaponifiables on collagen synthesis and fibroblast proliferation was investigated in vitro using a reconstructed epidermis model (BIOalternatives, Gencay, France). The test substances were applied topically to SkinEthic epidermis at a concentration of 4 mg/cm2. After incubation for 24 hours the medium containing diffused compounds and metabolites was transferred to the fibroblast culture followed by an incubation for 72 hours. In the first step, incorporation of radiolabelled proline was measured as a marker of protein synthesis while in the second step the incorporation of radiolabelled thymidine measured the rate of fibroblast proliferation.

The test on collagen synthesis expressed as inclusion of radiolabelled proline showed that the shea butter unsaponifiables do not stimulate collagen production in reconstituted epidermis. However, the effect on fibroblast proliferation was significant, with an observed 180% increase in thymidine incorporation compared to untreated control.

The fibroblast stimulating effect of the shea butter unsaponifiables was significant and may help to explain the traditional West African use of shea butter for wound healing and treatment of burns since fibroblasts are strongly associated with skin and tissue repair. The lack of increased collagen production may be explained by either lack of real effect or by the experimental protocol. The tested concentration again indicates a use of 0.1-0.5% of the shea butter unsaponifiable fraction in skin care formulations.

Table 4. Anti-inflammatory (AI) activity of shea butter unsaponifiables

	C=0		C=0.5 mg/ml		C=1 mg/ml		C=5 mg/ml	
	B	T	B	T	B	T	B	T
IL-1 (pg/microg)	20,8	56,5	22,8	51,3	22,4	48,1	21,1	48,7
IL-1 increase (times)	2,72		2,25		2,15		2,31	
AI activity			20		28		23	

B = background. T = treated

Formulating with Lipex® Shea Butter Family

The versatility of using the Lipex® Shea Butter Family is illustrated not only by the large amount of commercial products containing shea butter, but also by the guide formulations issued by AarhusKarlshamns' application laboratory. Table 5 gives a rough guideline for selecting a suitable combination of ingredients for many types of formulations.

There are several reasons for introducing shea butter in a skin care formulation. If the use of shea butter is only for labelling reasons and the amount of shea butter in the formulation is below 2 %, then any standard shea butter will usually function well. When using higher amounts of shea butter in the formulation for skin feel and moisturising benefits, it becomes necessary to pay attention to the crystallisation behaviour of the shea butter. Using liquid shea butter, Lipex® 205, normally avoids the crystallisation problem but working with liquids only restricts the possibility to change the product rheology. In this case, products such as Lipex® Shea and Lipex® 512 have obvious benefits with their simple crystallisation and high stability.

Quite often the rationale for using shea butter in skin care formulation is due to the skin repairing and skin healing effect of the shea butter unsaponifiables. In this case using ingredients with high amount of triterpene esters is recommended. Liquid shea butter, Lipex® 205, has about 7-8% of triterpene esters while Lipex® Shea-U has about 20% of these bioactive compounds. This opens up possibilities to tailor the skin feel and consistency of the formulation to suit different skin types and customer/market preferences.

Many examples showing the possibilities formulating with the Lipex® Shea Butter Family are given in the Lipids for Care Formulary.

Processing of formulations containing Lipex® Shea Butters

In general, semi-solid vegetable fats are sensitive towards the processing conditions, especially the cooling rate and temperature. A faster cooling gives firmer products with glossier surfaces while slower cooling can give large, coarse crystals and a soft texture with higher sweating tendency. Anhydrous products and w/o emulsions are more sensitive than o/w emulsions towards the cooling conditions since oils and fats have better insulating properties than water, making heat transfer from the product more difficult. The differences in cooling conditions need to be considered when scaling up from laboratory to production scale.

The semi-solid Lipex® Shea Butters show their optimal behaviour if cooled from 60-80 °C to 20-22 °C for Lipex® Shea and Lipex® 512 and 22-24 °C for Lipex® Sheasoft, using a cooling temperature of 8-12 °C. Cooling at higher temperatures (14-16 °C) will give softer products but will also prolong cooling times. The exact temperatures and cooling times will be dependent on processing equipment, package design and materials, the rest of the formulation and pouring temperature.

Table 5: Selecting shea butters for different applications

Application	Lipex® Shea Butter type	Addition level (%)	Claims/benefits	Comments
O/W body butters Body creams and rich lotions Intense face moisturisers	Lipex® 205 + Lipex® Shea	10 % + 10%	High content of shea butter for moisturisation and caring properties	Adjust consistency but changing liquid/solid ratio
W/O body butters Rich night creams Skin lipid restoring creams Baby care creams	Lipex® Sheasoft / Lipex® 205 / Lipex® L'sens	10 % / 5-10 % / 1-3 %	Lipex® L'sens improves w/o emulsions	Use w/o-tending emulsifiers such as Akoline PGPR
Anhydrous body butters Spa massage products Aromatherapy bases Dry skin relief products	Lipex® Sheasoft/ Lipex® Shea 4:1	50-100 %	Very rich skin feel, high moisturising effect	Use light esters to modify skin feel
Light skin care lotions Cream-gels Semi-liquid emulsions Cleansing wipes Body oils	Lipex® Shea WL	0.5% + 4 %	Very light, non-oily skin-feel with high level of shea butter unsaponifiables in formulation	
"Oil-free" creams and lotions	Lipex® Shea W + Lipex® Shea WL	5 + 10 %	Combines liquid and solid shea wax	Modify spreading cascade with other emollients
Lip balms	Lipex® Shea W + Lipex® Shea WL	5 + 10 %	Combines liquid and solid shea waxes	Modify consistency with other waxes and liquid emollients
Lip balms Lip ointments	Lipex® 205 + Lipex® Shea	20 + 5 %	Liquid shea butter gives skin care benefits but is easier to use in solid formulations	Use natural waxes to give firmness to product
Lipsticks	Lipex® 205 Lipex® Shea WL	10-20 % 10-20 %	Liquid shea butter and liquid shea wax give caring benefits but are easier to incorporate in sensitive applications	Solid shea butters are difficult to incorporate in stick formulations

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