Safety Assessment of *Butyrospermum parkii* (Shea)-Derived Ingredients as Used in Cosmetics

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All interested persons are provided 60 days from the above date to comment on this safety assessment and to identify additional published data that should be included or provide unpublished data which can be made public and included. Information may be submitted without identifying the source or the trade name of the cosmetic product containing the ingredient. All unpublished data submitted to CIR will be discussed in open meetings, will be available at the CIR office for review by any interested party and may be cited in a peer-reviewed scientific journal. Please submit data, comments, or requests to the CIR Director, Dr. Lillian J. Gill.

The 2016 Cosmetic Ingredient Review Expert Panel members are: Chairman, Wilma F. Bergfeld, M.D., F.A.C.P.; Donald V. Belsito, M.D.; Ronald A. Hill, Ph.D.; Curtis D. Klaassen, Ph.D.; Daniel C. Liebler, Ph.D.; James G. Marks, Jr., M.D.; Ronald C. Shank, Ph.D.; Thomas J. Slaga, Ph.D.; and Paul W. Snyder, D.V.M., Ph.D. The CIR Director is Lillian J. Gill, DPA. This safety assessment was prepared by Christina L. Burnett, Scientific Analyst/Writer and Bart Heldreth, Ph.D., Chemist CIR.

1620 L St NW, Suite 1200◊ Washington, DC 20036-4702 ◊ ph 202.331.0651 ◊fax 202.331.0088
◊ cirinfo@cir-safety.org

ABSTRACT

The Cosmetic Ingredient Review (CIR) Expert Panel (Panel) assessed the safety of 13 *Butyrospermum parkii* (shea)-derived ingredients, which are most frequently reported to function in cosmetics as skin and hair conditioning agents. The Panel reviewed the available data to determine the safety of these ingredients. Because final product formulations may contain multiple botanicals, each containing similar constituents of concern, formulators are advised to be aware of these constituents and to avoid reaching levels that may be hazardous to consumers. Industry should use good manufacturing practices to limit impurities that could be present in botanical ingredients. The Panel concluded that the 9 butter, oil, and glyceride ingredients are safe as used in the present practices of use and concentration as described in this safety assessment, while the data on the 4 nut and seedcake ingredients are insufficient to determine safety.

INTRODUCTION

The *Butyrospermum parkii* (shea)-derived ingredients detailed in this report function mainly as skin and hair conditioning agents in personal care products according to the *International Cosmetic Ingredient Dictionary and Handbook* (*Dictionary*).[1] This report assesses the safety of the following 13 *Butyrospermum parkii* (shea)-derived ingredients:

Butyrospermum Parkii (Shea) Butter
Butyrospermum Parkii (Shea) Butter Extract
Butyrospermum Parkii (Shea) Butter Unsaponifiables
Butyrospermum Parkii (Shea) Nut Extract
Butyrospermum Parkii (Shea) Nut Shell Powder
Butyrospermum Parkii (Shea) Oil
Butyrospermum Parkii (Shea) Seedcake Extract
Hydrogenated Shea Butter
Hydrogenated Shea Oil
Hydrolyzed Shea Seedcake Extract
Shea Butter Glyceride
Shea Butter Glycerides
Shea Oleine

The Panel previously reviewed the safety of Butyrospermum Parkii (Shea) Oil, Butyrospermum Parkii (Shea) Butter, Butyrospermum Parkii (Shea) Butter Unsaponifiables, and Hydrogenated Shea Butter in the 2011 safety assessment of plant-derived fatty acid oils and found these ingredients to be safe as used in cosmetics.[2] Because data from the previous assessment may help to inform the safety of the ingredients listed in this current assessment, the relevant information has been summarized here in italics.

Botanicals such as *Butyrospermum parkii* (shea)-derived ingredients may contain hundreds of constituents, some of which may have the potential to cause toxic effects. In this assessment, CIR is reviewing the potential toxicity of each of the *Butyrospermum parkii* (shea)-derived ingredients as a whole, complex mixture. Except for specific constituents of concern, CIR will not review the potential toxicity of the individual constituents found in *Butyrospermum parkii* from which the ingredients in this report are derived.

The ingredient names, according to the *Dictionary*, are written as listed above, without italics and without abbreviations. When referring to the tree from which these ingredients are derived, the standard scientific practice of using italics will be followed (e.g., *Butyrospermum parkii*). The shea tree is also known taxonomically as *Vitellaria paradoxa* and is referred to as such by many references and by the Food and Drug Administration (FDA).

While shea oleine ("oleine" is an oleate triglyceride) is not an ingredient listed in the *Dictionary*, toxicity data for this substance may be useful for assessing the safety of the *Butyrospermum parkii* (shea)-derived ingredients, using an inference approach. (Triolein, the triester of glycerin and oleic acid, was previously reviewed by the Panel and was found safe as used in cosmetics).[3] Shea oleine is listed as a cosmetic ingredient in the FDA Voluntary Cosmetic Registration Program (VCRP) database.

CHEMISTRY

Definition

The definitions and functions of the *Butyrospermum parkii* (shea)-derived ingredients included in this report are provided in Table 1.

Plant Identification

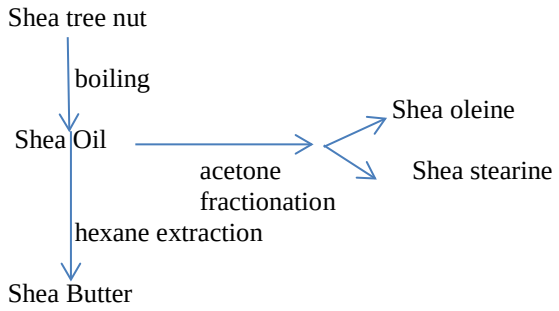
The raw materials for the *Butyrospermum parkii* (shea)-derived ingredients found in this report are obtained from the tree *Butyrospermum parkii*, which grows in mainly in equatorial Africa.[4-6]

Physical and Chemical Properties

Butyrospermum Parkii (Shea) Butter is a grey, tallow-like solid, with a specific gravity of 0.918 at 15°C and a melting point of 32-46 °C. [2] Butyrospermum Parkii (Shea) Oil is a pale yellow liquid. No other relevant published physical and chemical properties data on *Butyrospermum parkii* (shea)-derived ingredients were identified in a literature search for these ingredients, and no unpublished data were submitted.

Method of Manufacture

The general description of the method of manufacturing of several *Butyrospermum parkii* (shea)-derived ingredients is described in the following schematic:[7]



Butyrospermum Parkii (Shea) Butter Unsaponifiables

Butyrospermum Parkii (Shea) Butter Unsaponifiables is obtained by molecular distillation and supercritical carbon dioxide extraction of Butyrospermum Parkii (Shea) Butter.[8]

Composition/Impurities

The mean tocopherol concentrations and fatty acid compositions of *Butyrospermum parkii* (shea)-derived ingredients are provided in Table 2 and Table 3, respectively. While *Butyrospermum parkii* grows mainly in equatorial Africa, subtle differences in geographic location and climate affect the levels of the natural compounds, such as tocopherol and fatty acids, in *Butyrospermum parkii* (shea)-derived ingredients.[4,5]

A study of Butyrospermum Parkii (Shea) Butter (described as kernel fats; n-hexane extraction) from 36 samples from seven different countries found the principal triacylglycerols to be stearic-oleic-stearic (mean 31.2% of total triacylglycerols), stearic-oleic-oleic (27.7%), and oleic-oleic-oleic (10.8%).[9] Triterpene ester contents ranged from 0.5% to 6.5% and consisted of α-amyrin cinnamate (mean 29.3% of total triterpene esters), butyrospermol cinnamate (14.8%), α-amyrin acetate (14.1%), lupeol cinnamate (9.0%), β-amyrin cinnamate (7.6%), lupeol acetate (7.2%), butyrospermol acetate (5.8%, and β-amyrin acetate (4.9%) (Figure 1).

The same researchers identified the content and composition of triterpene alcohol fractions of the non-saponifiable lipids of Butyrospermum Parkii (Shea) Butter from 36 samples.[10] The shea kernels contained 30%-54% fat, of which 2%-12% were non-saponifiable lipids. Triterpene alcohol content in the non-saponifiable lipids was 22%-72%. The triterpene alcohol fractions contained α-amyrin, β-amyrin, lupeol, and butyrospermol with minor or trace amounts of ψ-taraxasterol, taraxasterol, parkeol, 24-methylene-24-dihydroparkeol, 24-methylenecycloartanol, dammaradienol, and 24-methylenedammarenol.

An analysis of the phenolic constituents of shea kernels by liquid chromatography-mass spectrometry (LC-MS) identified the following catechin compounds: gallic acid, catechin, epicatechin, epicatechin gallate, gallocatechin, epigallocatechin, gallocatechin gallate, and epigallocatechin gallate.[6] Quercetin and *trans*-cinnamic acid were also identified. The mean kernel content of the catechin compounds was 4000 ppm with a range of 2100-9500 ppm.

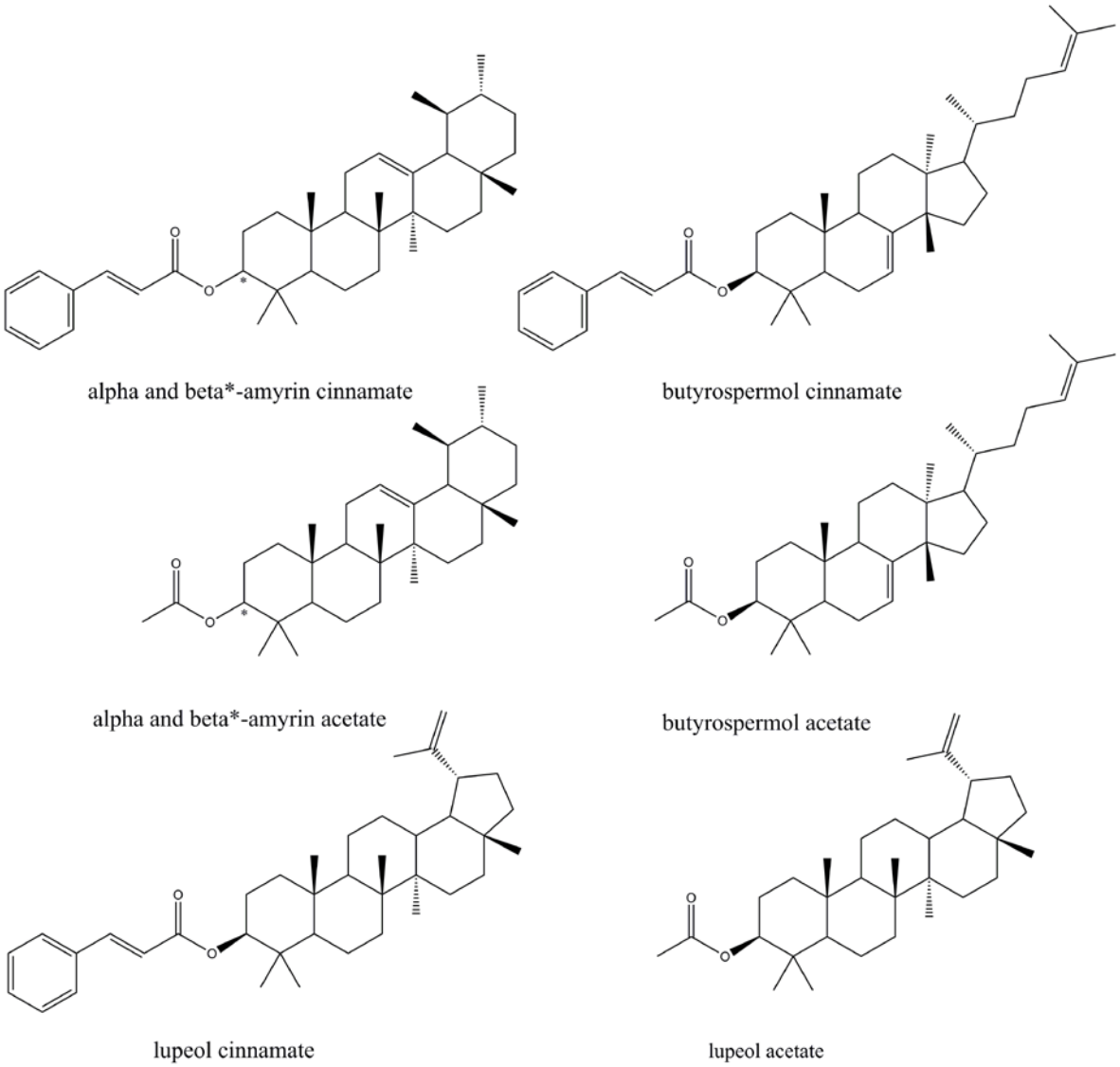


Figure 1. Triterpene esters.

Butyrospermum Parkii (Shea) Butter Unsaponifiables

Butyrospermum Parkii (Shea) Butter Unsaponifiables mainly contain terpene alcohols present in the butter in the form of cinnamic acid esters (including α- and β-amyrin lupeol, butyrospermol, and cycloartenol) and phytosterols including α-spinasterol, Δ7-stigmasterol, and stigmasterol).[8]

Shea Oleine

The primary component of shea oleine is the oleate triglyceride.

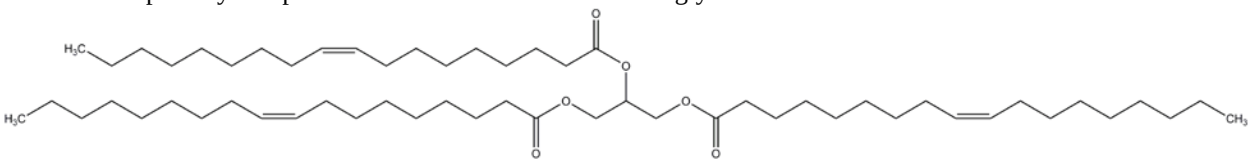


Figure 2. Oleate triglyceride.

However, the sterol component of shea oleine is approximately 8% (w/w), of which approximately 97% is 4,4-dimethylsterols (mostly as esters of cinnamic acid), 2% is 4-demethylsterols and 0.5% is 4-α-methylsterols.[7]

USE

Cosmetic

The safety of the cosmetic ingredients included in this assessment is evaluated based on data received from the U.S. Food and Drug Administration (FDA) and the cosmetics industry on the expected use of these ingredients in cosmetics. Use frequencies of individual ingredients in cosmetics are collected from manufacturers and reported by cosmetic product category in FDA's Voluntary Cosmetic Registration Program (VCRP) database. Use concentration data are submitted by Industry in response to surveys, conducted by the Personal Care Products Council (Council), of maximum reported use concentrations by product category.

According to 2016 VCRP data, Butyrospermum Parkii (Shea) Butter has the most reported uses of the ingredients listed in this safety assessment in cosmetic products, with a total of 4358; nearly three-fourths of the uses are in leave-on formulations (Table 4).[11,12] Butyrospermum Parkii (Shea) Butter Extract has the second greatest number of overall uses reported, with a total of 468; two-thirds of the uses are in leave-on formulations. The results of the concentration of use survey conducted in 2016 by the Council indicate Butyrospermum Parkii (Shea) Butter has the highest reported maximum concentration of use; it is used at up to 100% in moisturizers.[13] Butyrospermum Parkii (Shea) Oil is used at up to 11% in lipsticks.[14] No uses were reported for Hydrogenated Shea Oil or Hydrolyzed Shea Seedcake Extract.

In some cases, reports of uses were received from the VCRP, but no concentration of use data were provided. For example, Hydrogenated Shea Butter is reported to be used in 22 formulations, but no use concentration data were provided. In other cases, no uses were reported to the VCRP, but a maximum use concentration was provided in the industry survey. For example, Shea Butter Glyceride was not reported in the VCRP database to be in use, but the industry survey indicated that it is used at concentrations up to 0.49%. It should be presumed that Shea Butter Glyceride is used in at least one cosmetic formulation.

Some of these ingredients may be used in products that can be incidentally ingested or come into contact with mucous membranes. For example, Butyrospermum Parkii (Shea) Oil is used in lipsticks at up to 11%.[14] Additionally, some of these ingredients were reported to be used in hair sprays, face powders, fragrances and body and hand sprays and could possibly be inhaled. For example, Butyrospermum Parkii (Shea) Seedcake Extract was reported to be used in fragrance preparations at a maximum concentration of 4% and Butyrospermum Parkii (Shea) Unsaponifiables was reported to be used in a face powder at 0.06%.[13] In practice, 95% to 99% of the droplets/ particles released from cosmetic sprays have aerodynamic equivalent diameters >10 µm, with propellant sprays yielding a greater fraction of droplets/particles below 10 µm compared with pump sprays. Therefore, most droplets/ particles incidentally inhaled from cosmetic sprays would be deposited in the nasopharyngeal and bronchial regions and would not be respirable (i.e., they would not enter the lungs) to any appreciable amount. Conservative estimates of inhalation exposures to respirable particles during the use of loose powder cosmetic products are 400-fold to 1000-fold less than protective regulatory and guidance limits for inert airborne respirable particles in the workplace.[15-17]

The *Butyrospermum parkii* (shea)-derived ingredients described in this safety assessment are not restricted from use in any way under the rules governing cosmetic products in the European Union.[18]

Non-Cosmetic

Butyrospermum Parkii (Shea) Oil (sheanut oil), from which many of the ingredients of this report are derived, is generally recognized as safe (GRAS) in the U.S. as a direct food additive (21CFR§184.1702). It is used in confections and frostings, coatings of soft candy, and sweet sauces and toppings.

Refined sheanut oil is described as a component of a mixture of oils used as a cocoa butter substitute, as a coating agent, and in margarine and shortening in the *Food Chemicals Codex*, a compendium of internationally recognized standards published by the United States Pharmacopeia (USP) for the purity and identity of food ingredients.[19]

A triterpene-rich extract of *Butyrospermum parkii* has been reported to be used as a dietary supplement for the treatment of osteoarthritis.[20] Other studies have found that components of shea extracts potentially have anti-inflammatory, antioxidant, and anti-tumor effects.[21-24]

TOXICOKINETIC STUDIES

Absorption, Distribution, Metabolism, and Excretion (ADME)

Animal

Oral

Shea Oleine

In an oral absorption and excretion study, groups of Colworth Wistar male rats were fed shea oleine in a semisynthetic diet.[25] In a low-dose experiment, groups of 24 rats received control feed, feed containing 0.5% shea oleine, or feed containing 5% shea oleine for 1 week, with control feed administered to all rats the week prior and the week following the exposure week. In a high-dose experiment, 2 groups of 15 male and 15 female rats received either 10% or 20% shea oleine in the feed for 3 weeks. In the first experiment, feces were collected and pooled weekly for each treatment group throughout weeks 2 and 3. In the second experiment, feces were collected and pooled for each treatment group in week 3 only. The dried fecal matter of the rats was then analyzed with thin-layer and gas-liquid chromatography for fecal lipid, total sterol, differential sterol levels, and, specifically, 4,4-dimethyl-sterols (the main sterol constituent (~ 97%) of shea oleine). Excretion of 4,4-dimethylsterols increased with the consumption of shea oleine. Apparent absorption was 27% to 52% and was estimated from the disappearance of 4,4-dimethylsterols from the feces. The majority of the 4,4-dimethylsterols was excreted unchanged.

Human

Oral

Shea Oleine

The oral absorption and excretion of shea oleine was studied in 4 male volunteers.[25] On day 3 of an 8 day period, the subjects consumed a single 25 g portion (approximately 0.4 g/kg) of shea oleine in mayonnaise. No other vegetable fats were consumed during the course of the study. Feces were collected on days 3 to 8 inclusively, freeze-dried, and weighed. The dried fecal matter was analyzed in the manner described above. Excretion of 4,4-dimethylsterols increased with the consumption of shea oleine, with a marked increase from baseline on days 4 and 5 and a return to approximate baseline on day 8. Absorption of 4,4-dimethylsterols was estimated to be 13% to 49%. The majority of the 4,4-dimethylsterols was excreted unchanged.

TOXICOLOGICAL STUDIES

Acute Toxicity Studies

No relevant published acute toxicity studies on *Butyrospermum parkii* (shea)-derived ingredients were identified in a literature search for these ingredients, and no unpublished data were submitted.

Subchronic Toxicity Studies

Shea Oleine

In a 13-week rat feeding study, Colworth-Wistar rats received a diet containing 20% (w/w; 10 to 15 g/kg/day) shea oleine or hydrogenated shea oleine.[26] Groups of 15 male and 15 female rats were fed either 20% (w/w) palm oil, soy bean oil, or the hydrogenated equivalents. During the exposure period, body weight, food and water consumption, urine chemistry, and clinical pathology were assessed. Gross necropsy and microscopic examination of select tissues and organs were performed at study completion.

Results showed that shea oleine diets produced biological effects similar to those of palm oil and soy bean oil diets. Slightly reduced body weight gain was observed in rats fed either of the shea oleine diets when compared to diets with palm oil and soy bean oil. No significant differences in body weight gains were observed between rats fed hydrogenated shea oleine versus non-hydrogenated shea oleine. Slightly reduced cholesterol levels, increased aminotransferase levels, and lower triglyceride and alanine aminotransferase values were observed in rats fed non-hydrogenated diets, as were increased liver weights and reduced liver-lipid values. These changes were not considered to be biologically significant. Also considered biologically insignificant by the authors were raised alkaline phosphatase levels and increased food consumption in rats fed hydrogenated shea oleine. The authors concluded that all diets were well tolerated in the rats and considered none of the findings in this study to be adverse.[26]

Chronic Toxicity Studies

Butyrospermum Parkii (Shea) Oil and Shea Oleine

See Carcinogenicity section below.

DEVELOPMENTAL AND REPRODUCTIVE TOXICITY (DART) STUDIES

Oral

Butyrospermum Parkii (Shea) Oil and Shea Oleine

The reproductive toxicity potential of shea oleine and hydrogenated shea oleine was assessed in two dietary studies in rats.[27] In study 1, groups of 20 male and 20 female Colworth-Wistar rats received 7% (w/w; 3.5 g/kg/day) of either type of shea oleine in their diet for 20 weeks (breeding began at week 12 and lasted for 2 weeks). In study 2, groups of 50 male and 50 female Colworth-Wistar rats received 15% (w/w; 7.5 g/kg/day) of either type of shea oleine in their diets for 10 weeks (breeding began at week 2 and lasted for 1 week). Both studies also evaluated other commercially available materials, such as Butyrospermum Parkii (Shea) Oil (15% w/w, in study 2), palm oil, and cocoa butter. The rats received the test materials during pre-mating, mating, pregnancy and offspring weaning. Reproduction was assessed by counting the number of litters, pups born, and pups surviving, and measuring body weights at birth and at weaning on day 21. Skeletal evaluation using X-ray, clinical pathology and macroscopic examination were performed on F_1 rats. Parental animal parameters assessed were body weight, food consumption, clinical pathology, organ weights and macroscopic examination. Fatty acids and hydrocarbon levels were measured, and various tissues were evaluated in F_0 animals for lipogranulomata in Study 2.

Slightly reduced body weight gain, reduced cholesterol, and increased alkaline phosphatase levels were observed in rats treated with either shea oleine or hydrogenated shea oleine. No adverse effects on reproduction from any shea materials were observed in either study for any parameter. Results showed that shea oleine and hydrogenated shea oleine were toxicologically comparable to the other commercially available materials used in this study. The authors concluded that there was no evidence of reproductive toxicity following dietary exposure to shea oleine and hydrogenated shea oleine in rats at concentrations equating to greater than 15% (7.5 g/kg/day).[27]

GENOTOXICITY

In Vitro

Butyrospermum Parkii (Shea) Butter and Butyrospermum Parkii (Shea) Butter Unsaponifiables

A material containing Butyrospermum Parkii (Shea) Butter (70%) and Butyrospermum Parkii (Shea) Butter Unsaponifiables (30%) was not mutagenic in an Ames test.[8] The test material was tested at 50 to 5000 µg/plate, with and without metabolic activation. No further details were provided.

CARCINOGENICITY

Oral

Butyrospermum Parkii (Shea) Oil and Shea Oleine

The carcinogenic potential of shea oleine was evaluated in a dietary study in Colworth-Wistar rats for 104 weeks.[7] The study also evaluated Butyrospermum Parkii (Shea) Oil and palm oil. Groups of 50 male and 50 female rats received diets containing 15% (w/w; approximately equivalent to 7.5 g/kg/day) shea oleine, 15% (w/w) Butyrospermum Parkii (Shea) Oil, or 15% (w/w) palm oil. The rats were the offspring of the animals used in the reproduction study described above (study 2) and the test diets began at weaning (21 days of age). The following parameters were assessed: mortality, clinical signs of toxicity, body weight, food intake, clinical pathology, organ weights and macroscopic and histopathological changes plus tumor type and incidence evaluation.

Final mortality rates for both sexes for shea oleine and Butyrospermum Parkii (Shea) Oil were in the range of 28% to 30% each, while the mortality rates for both sexes exposed to palm oil was 40%. No clinical signs of toxicity were found after exposure to either shea test material. Reduced body weight gain and increased feed intake were observed in rats of both sexes fed either shea diets, while reduced cholesterol was observed in females fed the shea oleine diet. Increased alkaline phosphatase levels were observed in both sexes fed the Butyrospermum Parkii (Shea) Oil diet, but this value was only increased in females fed the shea oleine diet. Reduced heart weight and an increased incidence of pulmonary lipidosis were observed in rats of both sexes fed either shea diet. In females fed either shea diet, an increase in the number of hepatomas was observed, while in males fed shea oleine, increases in pancreatic exocrine adenomas and skin keratoacanthomas were observed. The increase in the incidence of hepatomas was thought to be related to the high fat content of the diets. The authors concluded that none of the

findings in this study were adverse effects and that shea oleine showed no tumorigenic potential in the rat at 15% in the diet (7.5 g/kg/day) when compared to Butyrospermum Parkii (Shea) Oil and palm oil.[7]

DERMAL IRRITATION AND SENSITIZATION STUDIES

Irritation

Dermal irritation studies are summarized in Table 5. [8,28,29] A material containing Butyrospermum Parkii (Shea) Butter (70%) and Butyrospermum Parkii (Shea) Butter Unsaponifiables (30%) was non-irritating in an EpiSkin™ assay when tested undiluted and in a human primary cutaneous tolerance test at a 30% dilution in paraffin oil. Butyrospermum Parkii (Shea) Butter Extract at 5% in a moisturizer was not irritating in human irritation studies.

Butyrospermum Parkii (Shea) Butter

In an EpiSkin™ in vitro assay, 24.1% Butyrospermum Parkii (Shea) Butter in a lip wax was not an irritant.[2] In animal study, Butyrospermum Parkii (Shea) Butter (concentration not reported) produced very slight erythema with or without edema in 2/3 rabbits exposed to the test material for 4 h in an irritation study utilizing occlusive patches. The erythema was resolved 3 or 4 days after patching. Butyrospermum Parkii (Shea) Butter did not cause primary cutaneous irritation when tested at up to 2%. No irritation to Butyrospermum Parkii (Shea) Butter was observed in human volunteers for in-use studies of lip gloss or body/hand massage oils at concentrations up to 45%.

Sensitization

Dermal sensitization studies are summarized in Table 6. [8,30-33] A material containing Butyrospermum Parkii (Shea) Butter (70%) and Butyrospermum Parkii (Shea) Butter Unsaponifiables (30%) was considered non-sensitizing in a direct peptide reactivity assay when tested undiluted. Butyrospermum Parkii (Shea) Butter Extract was non-sensitizing in human patch tests up to 5% in formulation.

Butyrospermum Parkii (Shea) Butter

Butyrospermum Parkii (Shea) Butter was not sensitizing in a guinea pig maximization study.[2] The induction concentration was 75% and the challenge concentrations were 20% and 50%. No sensitization was observed in multiple HRIPTs with products containing Butyrospermum Parkii (Shea) Butter. Concentrations tested were up to 60%.

Phototoxicity and Photosensitization

In Vitro

Butyrospermum Parkii (Shea) Butter Unsaponifiables

A material containing Butyrospermum Parkii (Shea) Butter (70%) and Butyrospermum Parkii (Shea) Butter Unsaponifiables (30%) was considered non-phototoxic in a 3T3 NRU assay when tested at 0.005 to 1 mg/ml.[8] This study was performed in accordance to Organization for Economic Co-operation and Development's (OECD) TG 432. No further details were provided.

Animal

Butyrospermum Parkii (Shea) Butter

Butyrospermum Parkii (Shea) Butter was not phototoxic in guinea pigs when tested at 10 and 20% in acetone.[2] The test sites were irradiated with UV-B light for 80 seconds followed by UV-A light for 80 min.

OCULAR IRRITATION STUDIES

In Vitro

Butyrospermum Parkii (Shea) Butter Unsaponifiables

A balm containing 1.5% of the mixture Butyrospermum Parkii (Shea) Butter (70%) and Butyrospermum Parkii (Shea) Butter Unsaponifiables (30%) was considered non-irritating in a Skinethic reconstituted mucous model.[8] Approximately 10 µl of the balm was applied undiluted for 24 h. The negative control was phosphate buffer saline and the positive control was 0.1% and 3% sodium dodecyl sulfate). No further details were provided.

Animal

Butyrospermum Parkii (Shea) Butter

While mild conjunctival reactions were observed, undiluted Butyrospermum Parkii (Shea) Butter was considered not irritating when tested in the eyes of male rabbits.[2]

SUMMARY

The 13 *Butyrospermum parkii* (shea)-derived ingredients detailed in this report function mainly as skin and hair conditioning agents in personal care products.

According to 2016 VCRP data, Butyrospermum Parkii (Shea) Butter has the most reported uses of the ingredients listed in this safety assessment in cosmetic products, with a total of 4358; nearly three-fourths of the uses are in leave-on formulations. Butyrospermum Parkii (Shea) Butter Extract has the second greatest number of overall reported, with a total of 468; about two-thirds of the uses are in leave-on formulations. The results of the concentration of use survey conducted in 2016 by the Council indicate Butyrospermum Parkii (Shea) Butter has the highest reported maximum concentration of use; it is used at up to 100% in moisturizers. Butyrospermum Parkii (Shea) Oil is used at up to 11% in a lipstick. No uses were reported for Hydrogenated Shea Oil or Hydrolyzed Shea Seedcake Extract.

Butyrospermum Parkii (Shea) Oil is a GRAS direct food additive in the U.S. It is used as a cocoa butter substitute in confections and frostings, coatings of soft candy, and sweet sauces and toppings. It is also used as a margarine or shortening. Components of shea extracts have potential anti-inflammatory, antioxidant, and anti-tumor effects.

Oral absorption and excretion studies of rats fed up to 20% shea oleine in a semisynthetic diet found excretion of 4,4-dimethylsterols increased with the consumption of shea oleine. Apparent absorption of shea oleine was 27% to 52%, as measured by 4,4-dimethylsterols. The majority of the 4,4-dimethylsterols was excreted unchanged. The findings for the absorption and excretion of approximately 0.4 g/kg in a single dose study of human volunteers were similar, with the absorption of shea oleine estimated to be 13% to 49%, as measured by 4,4-dimethylsterols.

In a 13-week rat feeding study, shea oleine or hydrogenated shea oleine (20% w/w, equivalent to 10-15 g/kg/day, for both test materials) did not produced adverse effects. No reproductive effects were observed in rats fed shea oleine or hydrogenated shea oleine (up to 15% w/w, equivalent to 7.5 g/kg/day, for both test materials) for up to 20 weeks. No tumorigenic potential or adverse effects to shea oleine (15% w/w, equivalent to 7.5 g/kg/day) was observed in a carcinogenicity study in the offspring of the rats from the reproductive study.

A material containing Butyrospermum Parkii (Shea) Butter (70%) and Butyrospermum Parkii (Shea) Butter Unsaponifiables (30%) was not mutagenic in an Ames test.

A material containing Butyrospermum Parkii (Shea) Butter (70%) and Butyrospermum Parkii (Shea) Butter Unsaponifiables (30%) was non-irritating in an EpiSkin™ assay when tested undiluted and in a human primary cutaneous tolerance tested at a 30% dilution in paraffin oil. Butyrospermum Parkii (Shea) Butter Extract at 5% in a moisturizer was not irritating in human irritation studies.

A material containing Butyrospermum Parkii (Shea) Butter (70%) and Butyrospermum Parkii (Shea) Butter Unsaponifiables (30%) was considered non-sensitizing in a direct peptide reactivity assay when tested undiluted. Butyrospermum Parkii (Shea) Butter Extract was non-sensitizing in human patch tests at up to 5% in formulation.

A material containing Butyrospermum Parkii (Shea) Butter (70%) and Butyrospermum Parkii (Shea) Butter Unsaponifiables (30%) was considered non-phototoxic in a 3T3 NRU assay when tested at 0.005 to 1 mg/ml.

A balm containing 1.5% of the mixture Butyrospermum Parkii (Shea) Butter (70%) and Butyrospermum Parkii (Shea) Butter Unsaponifiables (30%) was considered non-irritating in a Skinethic reconstituted mucous model.

No relevant published acute toxicity or clinical studies on *Butyrospermum parkii* (shea)-derived ingredients were identified in a literature search for these ingredients and no unpublished data were submitted.

DISCUSSION

The Panel noted that, because botanical ingredients are complex mixtures, there is concern that multiple botanical ingredients in one formulation may each contribute to the final concentration of a single constituent. Therefore, when formulating products, manufacturers should avoid reaching levels in final formulation of botanical constituents that may cause sensitization or other adverse effects.

The Panel discussed the issue of incidental inhalation exposure from hair sprays, fragrance preparations, body and hand sprays, and face powders. There were no inhalation toxicity data available. The Panel noted that

droplets/particles from spray and loose-powder cosmetic products would not be respirable to any appreciable amount. The potential for inhalation toxicity is not limited to respirable droplets/particles deposited in the lungs. In principle, inhaled droplets/particles deposited in the nasopharyngeal and thoracic regions of the respiratory tract may cause toxic effects depending on their chemical and other properties. However, coupled with the small actual exposure in the breathing zone and the concentrations at which the ingredients are used, the available information indicates that incidental inhalation would not be a significant route of exposure that might lead to local respiratory or systemic effects. A detailed discussion and summary of the Panel's approach to evaluating incidental inhalation exposures to ingredients in cosmetic products is available at http://www.cir-safety.org/cir-findings.

The Panel also expressed concern about pesticide residues, heavy metals, and other plant species that may be present in botanical ingredients. They stressed that the cosmetics industry should continue to use current good manufacturing practices (cGMPs) to limit impurities.

The ingredient Butyrospermum Parkii (Shea) Butter is reported to be used at concentrations up to 100%. While there are no safety test data for this ingredient at this maximum concentration, the Panel was not concerned about dermal irritation or sensitization because of clinical experience and the absence of adverse event reports. The Panel considered the available data on the remaining butter, oil, and glyceride ingredients and found that data were adequate to support the safety of these ingredients as they are used in cosmetics. However, the Panel found that the data are insufficient to make a conclusion on the safety of the 4 nut- and seedcake-derived ingredients in this safety assessment. The data that are needed to properly evaluate the safety of these ingredients are:

- Method of manufacturing for Butyrospermum Parkii (Shea) Nut Extract, Butyrospermum Nut Shell Powder, Butyrospermum Parkii (Shea) Seedcake Extract, and Hydrolyzed Shea Seedcake Extract
- Composition and impurities data on the above listed nut and seedcake ingredients
- Sensitization data on the above listed nut and seedcake ingredients.

CONCLUSION

The CIR Expert Panel concluded that the following 9 ingredients are safe as used in the present practices of use and concentration as described in this safety assessment.

Butyrospermum Parkii (Shea) Butter
Buyrospemum Parkii (Shea) Oil
Butyrospermum Parkii (Shea) Butter Extract
Butyrospermum Parkii (Shea) Butter Unsaponifiables
Hydrogenated Shea Butter
Hydrogenated Shea Oil*
Shea Butter Glyceride
Shea Butter Glycerides
Shea Oleine

The Panel concluded that the data on the 4 ingredients listed below are insufficient to determine safety.

Butyrospermum Parkii (Shea) Nut Extract
Butyrospermum Parkii (Shea) Nut Shell Powder
Butyrospermum Parkii (Shea) Seedcake Extract
Hydrolyzed Shea Seedcake Extract*

*Not reported to be in current use. Were ingredients in this group not in current use to be used in the future, the expectation is that they would be used in product categories and at concentrations comparable to others in this group.

TABLES AND FIGURES

Table 1. Definitions and functions of the ingredients in this safety assessment.[1]

Ingredient/CAS No.	Definition	Function
Butyrospermum Parkii (Shea) Butter CAS No. 91080-23-8; 194043-92-0	Butyrospermum Parkii (Shea) Butter is a fat obtained from the fruit of *Butyrospermum parkii*. The accepted scientific name for *Butyrospermum parkii* is *Vitellaria paradoxa*.	skin-conditioning agents – miscellaneous; skin-conditioning agents – occlusive; viscosity increasing agents - nonaqueous
Butyrospermum Parkii (Shea) Butter Extract CAS No. 91080-23-8	Butyrospermum Parkii (Shea) Butter Extract is the extract of Butyrospermum Parkii (Shea) Butter. The accepted scientific name for *Butyrospermum parkii* is *Vitellaria paradoxa*.	skin-conditioning agents - miscellaneous
Butyrospermum Parkii (Shea) Butter Unsaponifiables CAS No. 194043-92-0; 225234-14-0	Butyrospermum Parkii (Shea) Butter Unsaponifiables is the fraction of shea butter which is not saponified in the refining recovery of shea butter fatty acids. The accepted name for *Butyrospermum parkii* is *Vitellaria paradoxa*.	hair conditioning agents; skin-conditioning agents - miscellaneous
Butyrospermum Parkii (Shea) Nut Extract CAS No. 91080-23-8	Butyrospermum Parkii (Shea) Nut Extract is the extract of the nuts *of Butyrospermum parkii*. The accepted name for *Butyrospermum parkii* is *Vitellaria paradoxa*.	skin-conditioning agents - emollient
Butyrospermum Parkii (Shea) Nut Shell Powder CAS No. 91080-23-8	Butyrospermum Parkii (Shea) Nut Shell Powder is the powder obtained from the dried, ground nut shells of *Butyrospermum parkii*. The accepted scientific name for *Butyrospermum parkii* is *Vitellaria paradoxa*.	abrasives
Butyrospermum Parkii (Shea) Oil CAS No. 91080-23-8	Butyrospermum Parkii (Shea) Oil is the liquid fraction obtained from Butyrospermum Parkii (Shea) Butter. The accepted name for *Butyrospermum parkii* is *Vitellaria paradoxa*.	skin-conditioning agents – miscellaneous; skin-conditioning agents - occlusive
Butyrospermum Parkii (Shea) Seedcake Extract CAS No. 91080-23-8	Butyrospermum Parkii (Shea) Seedcake Extract is the extract of the seedcake of *Butyrospermum parkii*. The accepted name for *Butyrospermum parkii is Vitellaria paradoxa*.	skin protectants
Hydrogenated Shea Butter	Hydrogenated Shea Butter is the end product of the controlled hydrogenation of Butyrospermum Parkii (Shea) Butter.	skin-conditioning agents – occlusive; viscosity increasing agents - nonaqueous
Hydrogenated Shea Oil CAS No. 93333-83-6	Hydrogenated Shea Oil is the product obtained by the hydrogenation of Butyrospermum Parkii (Shea) Oil.	skin conditioning agents – emollient; skin-conditioning agents - occlusive
Hydrolyzed Shea Seedcake Extract	Hydrolyzed Shea Seedcake Extract is the hydrolysate of an extract of shea seedcake derived by acid, enzyme, or other method of hydrolysis.	not reported
Shea Butter Glyceride	Shea Butter Glyceride is the monoglyceride derived from Butyrospermum Parkii (Shea) Butter.	skin-conditioning agents – emollient; surfactants – emulsifying agents
Shea Butter Glycerides CAS No. 194043-92-0; 1016637-12-9	Shea Butter Glycerides are a mixture of mono-, di-, and triglycerides derived from Butyrospermum Parkii (Shea) Butter.	emulsion stabilizers; hair conditioning agents; skin-conditioning agents – miscellaneous; slip modifiers; surfactants – emulsifying agents; viscosity increasing agents - aqueous
Shea Oleine	Not in *Dictionary*.	Not in *Dictionary*.

Table 2. Mean concentrations of tocopherols in 102 Butyrospermum Parkii (Shea) Butter samples by HPLC analysis (μg/g)[4]

α-tocopherol	β-tocopherol	γ-tocopherol	δ-tocopherol	total tocopherol
112	16	38	34	208

Table 3. Total fatty acid composition of *Butyrospermum parkii* (Shea)-derived ingredients (%) [2,5,34]

Fatty Acids	Butyrospermum Parkii (Shea) Oil	Butyrospermum Parkii (Shea) Butter
Myristic (C14)	NR	0.5
Palmitic (C16)	3.8-4.1	2.6-9
Stearic (C18)	41.2-56.8	25.6-50.2
Oleic (C18:1)	34.0-46.9	37.1-62.1
Linoleic (C18:2)	3.7-6.5	0.6-10.8
Linolenic (C18:3)	NR	0.5 max
Arachidic (C20)	1-2	0-3.5

NR-Not reported.

Table 4. Frequency and concentration of use according to duration and type of exposure for shea ingredients.[11-14]

	# of Uses	*Max Conc of Use (%)*	*# of Uses*	*Max Conc of Use (%)*	*# of Uses*	*Max Conc of Use (%)*	*# of Uses*	*Max Conc of Use (%)*
	Butyrospermum Parkii (Shea) Butter		**Butyrospermum Parkii (Shea) Butter Extract**		**Butyrospermum Parkii (Shea) Butter Unsaponifiables**		**Butyrospermum Parkii (Shea) Nut Extract**	
Totals†	**4358**	**0.0001-100**	**468**	**0.0000095-5**	**69**	**0.01-4.5**	**NR**	**0.0003-1**
Duration of Use								
Leave-On	3370	0.001-100	324	0.0000095-5	66	0.015-4.5	NR	0.01-1
Rinse Off	971	0.0001-10	140	0.00028-0.96	3	0.01-2	NR	0.0003-0.51
Diluted for (Bath) Use	17	0.05-3	4	0.05	NR	NR	NR	NR
Exposure Type								
Eye Area	227	0.1-8	19	0.5	38	0.16-0.5	NR	NR
Incidental Ingestion	382	0.01-9.4	36	0.075-1.9	3	0.25-2.5	NR	NR
Incidental Inhalation -Sprays	12; 1510[a]; 846[b]	0.1-0.33; 0.001-8[a]; 0.59[b]	10; 111[a]; 92[b]	0.001-0.025; 0.001-0.8[a]; 0.0001[b]	6[a]; 5[b]	0.5[a]	NR	NR
Incidental Inhalation - Powders	9; 26[c]; 846[b]	3; 0.59[b]; 0.05-8[c]	2; 8[c]; 92[b]	0.015; 0.0000095-5[c]; 0.0001[b]	3; 1[c]; 5[b]	0.06	NR	NR
Dermal Contact	3652	0.0004-100	409	0.0001-5	61	0.051-4.5	NR	0.0003-1
Deodorant (underarm)	16[a]	NR	1[a]	0.05	NR	NR	NR	NR
Hair - Non-Coloring	286	0.0001-8	23	0.001-0.96	5	0.01-0.5	NR	0.01
Hair-Coloring	23	0.004-3.5	NR	NR	NR	NR	NR	NR
Nail	8	0.1-5	NR	0.01	NR	NR	NR	NR
Mucous Membrane	1029	0.0004-9.4	116	0.00028-1.9	3	0.051-2.5	NR	0.0003-0.51
Baby Products	32	0.005-7	10	0.1	1	4	NR	NR

	Butyrospermum Parkii (Shea) Nut Shell Powder		**Butyrospermum Parkii (Shea) Oil**		**Butyrospermum Parkii (Shea) Seedcake Extract**		**Hydrogenated Shea Butter**	
Totals†	**2**	**0.00028-1**	**58**	**0.001-11**	**2**	**0.0002-5.5**	**22**	**NR**
Duration of Use								
Leave-On	2	0.01-1	28	0.01-11	2	0.0002-5.5	11	NR
Rinse Off	NR	0.00028-0.5	27	0.001-2.5	NR	0.0003-2	11	NR
Diluted for (Bath) Use	NR	NR	3	NR	NR	NR	NR	NR
Exposure Type								
Eye Area	NR	NR	2	0.5-8	NR	0.0002-5.5	NR	NR
Incidental Ingestion	NR	NR	1	0.5-11	NR	3	1	NR
Incidental Inhalation -Sprays	1[b]	NR	18[a]; 4[b]	1; 0.2[a]	2[a]	0.0095-4; 0.01[a]	1; 5[a]; 3[b]	NR
Incidental Inhalation - Powders	1[b]	NR	1; 4[b]	0.95-8[c]	NR	0.0012-5[c]	3[b]	NR
Dermal Contact	2	0.00028-1	54	0.005-8	2	0.0002-5.5	14	NR
Deodorant (underarm)	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	0.01	3	0.001-0.4	NR	0.001-0.99	7	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	0.1-2	NR	3-5	NR	NR
Mucous Membrane	NR	0.00028-0.0011	25	0.005-11	NR	0.0003-3	4	NR
Baby Products	NR	NR	NR	NR	NR	5	NR	NR

Table 4. Frequency and concentration of use according to duration and type of exposure for shea ingredients.[11-14]

	# of Uses	*Max Conc of Use (%)*	*# of Uses*	*Max Conc of Use (%)*	*# of Uses*	*Max Conc of Use (%)*	*# of Uses*	*Max Conc of Use (%)*
	Shea Butter Glyceride		**Shea Butter Glycerides**		**Shea Oleine**			
Totals†	**NR**	**0.49**	**31**	**0.49-6.5**	**3**	**NS**		
Duration of Use								
Leave-On	NR	NR	24	6.5	3	NS		
Rinse Off	NR	0.49	7	0.49-2	NR	NS		
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NS		
Exposure Type								
Eye Area	NR	NR	4	NR	NR	NS		
Incidental Ingestion	NR	NR	NR	NR	NR	NS		
Incidental Inhalation -Sprays	NR	NR	13[a]; 3[b]	NR	1; 1[a]	NS		
Incidental Inhalation - Powders	NR	NR	3[b]	0.49-6.5	NR	NS		
Dermal Contact	NR	0.49	27	NR	1	NS		
Deodorant (underarm)	NR	NR	NR	NR	NR	NS		
Hair - Non-Coloring	NR	NR	4	NR	2	NS		
Hair-Coloring	NR	NR	NR	NR	NR	NS		
Nail	NR	NR	NR	NR	NR	NS		
Mucous Membrane	NR	NR	2	2	NR	NS		
Baby Products	NR	NR	1	NR	NR	NS		

NR = No reported use

NS = Not surveyed

† Because each ingredient may be used in cosmetics with multiple exposure types, the sum of all exposure types may not equal the sum of total uses.

[a.] It is possible these products may be sprays, but it is not specified whether the reported uses are sprays.

[b.] Not specified whether a powder or a spray, so this information is captured for both categories of incidental inhalation.

[c.] It is possible these products may be powders, but it is not specified whether the reported uses are powders.

Table 5. Dermal irritation studies for *Butyrospermum parkii* (shea)-derived ingredients.

Test Article	Concentration/Dose	Test Population	Procedure	Results	Reference
In Vitro					
70% Butyrospermum Parkii (Shea) Butter and 30% Butyrospermum Parkii (Shea) Butter Unsaponifiables	undiluted	N/A	EpiSkin™ assay in accordance with OECD TG 439; no further details provided	Non-irritating	[8]
Human					
Butyrospermum Parkii (Shea) Butter Extract	5% in a moisturizer	46 subjects	Single-blind, 4-week clinical use study; test material applied twice daily in place of regular moisturizer; study supervised by a dermatologist who conducted baseline, 2-week interim, and final exams.	No irritation	[28]
Butyrospermum Parkii (Shea) Butter Extract	5% in a moisturizer	18 subjects	24-h single insult patch test; undiluted; occluded (Blenderm patch); no further details provided	No irritation	[29]
70% Butyrospermum Parkii (Shea) Butter and 30% Butyrospermum Parkii (Shea) Butter Unsaponifiables	30% diluted in paraffin oil	10 subjects	48-h primary cutaneous tolerance test; single patch; treated sites examined 30 min and 24 h post-patch removal; no further details provided	No irritation	[8]

Table 6. Dermal sensitization studies for *Butyrospermum parkii* (shea)-derived ingredients.

Test Article	Concentration/Dose	Test Population	Procedure	Results	References
			In Vitro		
70% Butyrospermum Parkii (Shea) Butter and 30% Butyrospermum Parkii (Shea) Butter Unsaponifiables	undiluted	N/A	Direct peptide reactivity assay; performed in accordance with the European Centre for the Validation of Alternative Methods (ECVAM) protocol; reactivity of test material evaluated by monitoring peptide depletion following 24-h contact between test material and synthetic cysteine and lysine peptides; no further details were provided.	Non-reactive and considered non-sensitizing	[8]
			Human		
Butyrospermum Parkii (Shea) Butter Extract	2% in a body lotion	28 healthy subjects	Maximization test; 0.05ml test material applied neat under an occlusive dressing to a sodium lauryl sulfate (SLS) pre-treated site on the upper arm; five 48-h induction patches were followed 7-10 days later with challenge on naïve site	Not sensitizing	[30]
Butyrospermum Parkii (Shea) Butter Extract	2% in a body lotion	26 healthy subjects	Maximization test; 0.05ml test material applied neat under an occlusive dressing to a SLS pre-treated site on the upper arm; five 48-h induction patches were followed 7-10 days later with challenge on naïve site	Not sensitizing	[31]
Butyrospermum Parkii (Shea) Butter Extract	5% in a face cream	25 healthy subjects	Maximization test; 0.05ml test material applied neat under an occlusive dressing to a SLS pre-treated site on the upper arm; five 48-h induction patches were followed 7-10 days later with challenge on naïve site	Not sensitizing	[32]
Butyrospermum Parkii(Shea) Butter Extract	1.7975% in a lipstick	104 subjects	HRIPT; 0.2 g test material applied to area 1 in^2 on upper back ; semi-occluded	Not a dermal irritant or dermal sensitizer	[33]

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