Amended Safety Assessment of Alkyl Esters as Used in Cosmetics

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ABSTRACT

The CIR Expert Panel assessed the safety of 237 alkyl esters for use in cosmetics, concluding that these ingredients are safe in cosmetic formulations in the present practices of use and concentration when formulated to be non-irritating. The alkyl esters included in this assessment have a variety of reported functions in cosmetics, with skin conditioning agent being the most common function. The Panel reviewed available animal and clinical data in making its determination of safety on these ingredients, and, where there were data gaps, similarity in structure, properties, functions and uses of these ingredients allowed for extrapolation of the available toxicological data to assess the safety of the entire group.

INTRODUCTION

This report is an expansion of an earlier safety assessment of cetyl esters. Cetyl esters is the International Nomenclature Cosmetic Ingredient (INCI) name for a synthetic wax composed of a mixture of esters of saturated fatty acids and fatty alcohols with carbon chain lengths between 14 and 18; this cosmetic ingredient was reviewed previously by the Cosmetic Ingredient Review (CIR) Expert Panel. In 1997, the Panel concluded that cetyl esters is safe as used in cosmetics.[1]

Cetyl esters is a constituent of a broader group of cosmetic ingredients, the alkyl esters, which consist of the reaction products of fatty acids and alcohols. The 237 alkyl esters being reviewed in this safety assessment are presented alphabetically in Table 1. Although 57 of these alkyl esters have been reviewed previously by the CIR Expert Panel,[1-21] they are included because of their structural and functional similarities, thereby creating a complete family of alkyl esters.

The conclusions reached for the previously-reviewed ingredients (including cetyl esters), along with summaries of the data included in those existing safety assessments, are provided in Table 2. The data available for these alkyl esters, which includes single-dose and repeated-dose toxicity, toxicokinetics, reproductive and developmental toxicity, genotoxicity, carcinogenicity, dermal and ocular irritation, and sensitization and photosensitization studies, support the safety of this class of cosmetic ingredients.

In addition, the CIR has previously concluded that many of the individual constituents that make up the alkyl esters, (i.e., the alcohol and/or the acid), are safe as used in cosmetics. Because the safety of the individual constituents may be relevant to the safety of the ester, Table 3 indicates whether all, one, or none of the individual constituents of each alkyl esters have been found safe for use in cosmetics and Table 4 provides the conclusions reported previously for those individual components. Although the individual constituents are relevant to the safety of the alkyl esters, the available data are well-documented in the existing CIR reports and will not be summarized here; however, the maximum reported concentration of use is provided to reflect contextual constraints.

Because the data from the existing safety assessments are included in Table 2, only new data will be included in the body of this safety assessment.

CHEMISTRY

Definition and Structure

The ingredients in this review are alkyl esters. The core relationship between these ingredients is a carboxyl ester functional group flanked on both sides by extended alkyl chains. Some of these alkyl chains are saturated and some are unsaturated, and some of the chains are straight and some branched. (Figure 1). Formal definitions for the ingredients included in this assessment are provided in Table 5.

Methods of Manufacture

Most of these alkyl esters are produced synthetically via classical Fischer type esterification methods (i.e., reaction of a carboxylic acid with an alcohol to produce a carboxylic ester; Figure 2), although the reaction may be promoted by acid or base catalysis, or by the use of an acid chloride.

However, some of the natural source ingredients in this review may be produced by transesterification (i.e., exchange of alcohol moieties to create a different ester product). For example, the triglycerides (i.e., glyceryl tri-**esters**) in natural oils can be reacted with alcohols to produce new monoesters (and diglycerides, monoglycerides, and glycerin, depending on reaction stoichiometry). Available methods of manufacture are summarized in Table 6.

Physical and Chemical Properties

Alkyl esters are hydrophobic materials that range from oils, at the lowest molecular weights/shortest chain-lengths, to waxy solids, at the highest molecular weights/longest chain-lengths. Physical and chemical properties data are provided in Table 7.

Impurities

One published reference stated that in the synthesis of oleate esters using sodium alcoholates (base catalyst), methyl oleate was the major impurity.[22] (The safety assessment of decyl and isodecyl oleate includes and took into account toxicity data on methyl oleate.[23])

USE

Cosmetic

The alkyl esters are reported to function in cosmetics mostly as skin conditioning agents.[24] Some of the alkyl esters are reported to have additional functions; for example, isooctyl tallate is reported to also function as a plasticizer and solvent, and tetradecyl-propionates is reported to function as a solvent. The reported functions of each ingredient are provided in Table 5.

The FDA collects information from manufacturers on the use of individual ingredients in cosmetic formulations as a function of cosmetic product category in its Voluntary Cosmetic Registration Program (VCRP). VCRP data obtained from the FDA in 2013[25] and data received in response to a survey of the maximum reported use concentration by category conducted by the Personal Care Products Council (Council)[26-28] indicate that 112 of the 237 alkyl esters named in this safety assessment are currently used in cosmetic formulations. Ethylhexyl palmitate has the most reported uses, 1525, followed by isopropyl myristate, 1182 reported uses, and isopropyl palmitate, 1125 reported uses. (Cetyl esters is reported to be used in 476 cosmetic formulations.) The results of the concentration of use survey indicate that many of the alkyl esters are used at high concentrations in cosmetic formulations. Ethylhexyl palmitate had the highest reported use concentration, 78% in body and hand preparations, followed by isopropyl myristate, which is used at 77.3% in other hair grooming aids and 76.6% in aerosol hair spray formulations.

The frequency and concentration of use data are summarized in Table 8. A number of these ingredients have been reviewed previously, and the historical data also are included in Table 8. The ingredients not in use according to the VCRP and industry survey are listed in Table 9.

In quite a few cases, reports of uses were received in the VCRP, but no concentration of use data are available. For example, caprylyl caprylate is reported to be used in 11 cosmetic formulations, but no use concentration data were reported. Additionally, there were quite a few instances in which no reported uses were received in the VCRP, but a use concentration was provided in the industry survey. For example, oleyl linoleate was not reported in the VCRP to be in use, but the industry survey indicated that it is used in leave-on formulations at up to 11%. It should be presumed in these cases that there is at least one use in every category for which a concentration is reported.

Some alkyl esters are reported to be used in baby skin products, to be used in products applied to the eye area or mucous membranes, or in products that could possibly be ingested. Additionally, some of the alkyl esters are used in cosmetic sprays and could possibly be inhaled. Examples of sprays at the highest concentrations of use are 76.6% isopropyl myristate in hair sprays, 45% ethylhexyl palmitate in indoor tanning preparations, and 23% isopropyl myristate in deodorant formulations. 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 <10 μm compared with pump sprays.[29,30] Therefore, most droplets/particles incidentally inhaled from cosmetic sprays would be deposited in the nasopharyngeal and thoracic regions of the respiratory tract and would not be respirable (i.e., they would not enter the lungs) to any appreciable amount.[31,32] There is some evidence indicating that deodorant spray products can release substantially larger fractions of particulates having aerodynamic equivalent diameters in the range considered to be respirable.[32] However, the information is not sufficient to determine whether significantly greater lung exposures result from the use of deodorant sprays, compared to other cosmetic sprays.

All of the alkyl esters named in this report, with the exception of behenyl olivate and hexyldodecyl/octyldecyl hydroxystearate, are listed in the European Union inventory of cosmetic ingredients.[33]

Non-Cosmetic

Isoamyl laurate and butyl stearate are approved as direct food additives for use as a flavor substance adjuvant (21CFR172.515). Many of the alkyl esters are approved as indirect food additives, as listed in the Code of Federal Regulations Title 21. Examples of non-cosmetic uses of some of the alkyl esters are provided in Table 10.

TOXICOKINETICS

Absorption, Distribution, Metabolism, and Excretion

Cetyl Myristoleate

Rats were fed chow containing 2% cetyl myristoleate or untreated feed for 2 h.[34] No cetyl alcohol was found in the stomach, intestinal content, or mucosa in either group. (Additional details were not provided).

Cetyl Oleate

Groups of five male albino rats were fed a diet containing 20% cetyl oleate for 9 days; control groups were fed a fat-free diet or a diet containing 20% cottonseed oil.[35] The animals were given 12 g of diet per day. The absorption of cetyl oleate was reported to be 75.3%. By day 2 of the study, the animals fed cetyl oleate developed seborrhea, which progressively increased with feeding. The animals were killed after the termination of dosing, and microscopic examination reported thickening and hyperemia of the intestinal wall. The exuded lipid was identified as cetyl oleate. The researchers stated that the absorbability and seborrhea suggested that cetyl oleate was not hydrolyzed in the gut.

The researchers then dosed groups of six male rats with 2 g of cetyl oleate or an equal mixture of cetyl oleate + tributyrin by gavage, and the animals were fed a fat-free diet. Control animals were dosed with sucrose. The animals were fasted overnight on day 10 of dosing, and two animals were then killed. Two of the remaining animals were killed 1 h and two were killed 3 h after a final dose. Seborrhea was observed in both test groups; only cetyl oleate was recovered from the exuded lipid in both test groups. Intestinal weight was markedly increased in the cetyl oleate + tributyrin group. The free fatty acid content of the stomach 3 h after dosing and of the small intestine 1 and 3 h after dosing was increased in the group dosed with cetyl oleate (only) when compared to controls. In the cetyl oleate + butyrin group, the free fatty acid content of the stomach was increased at both 1 and 3 h, and in the small intestine it was increased after 1 h.

Dermal Penetration

Isopropyl Myristate

Isopropyl myristate, as a non-polar penetration enhancer, is largely retained in the stratum corneum.[36] It was not detected in the receptor fluid of flow-through diffusion cells in in vitro skin permeation experiments using human epidermis (stratum corneum and viable epidermis) and dermis (varying thickness).

Isostearyl Isostearate

Pre-deuterated isostearyl isostearate, 7 µl/cm^2, was applied neat to a 2 cm x 8 cm site on the ventral forearm of 14 human subjects for 3 h under non-occlusive conditions.[37] The test site was tape-stripped 3 h after application, and attenuated total reflectance-Fourier transform infrared (ATF-FTIR) spectra measurements were determined. The researchers stated the most of the isostearyl isostearate was located at the surface of the stratum corneum. (The percent recovery of the amount applied was not specified.)

Penetration Enhancement

Isopropyl myristate is a non-polar penetration enhancer in pharmaceutical and cosmetic preparations. A 50:50 isopropanol-isopropyl myristate binary enhancer synergistically increased the transport of estradiol across a two-layer human epidermis in vitro.[36] The average thicknesses (two donors) of the stratum corneum and viable epidermis were 14 and 60 µm, respectively. Saturated estradiol solutions of the binary enhancer were used in the donor and the receiver. The isopropanol-isopropyl myristate binary volume ratio varied from 0:100, 25:75, 50:50, 75:25, 100:0 isopropanol-isopropyl myristate. The permeability coefficient was lowest for neat isopropyl myristate, increased with increasing isopropanol until a 50:50 ratio was reached, and then was relatively constant as the percent of isopropanol increased.

Isopropyl palmitate is reported to be used in topical formulations as a lipid layer penetration enhancer.[38] The skin penetration of three lipophilic compounds (partition coefficient order: gliclazide>nimesulfide>oxaproxin) and one hydrophilic compound (ribavirin) across excised rat abdominal skin after 2 h pre-treatment with 5-20% w/w isopropyl palmitate in ethanol was determined.[39] All pre-treatment solutions produced a significant increase in the flux and permeation of all four compounds; the effectiveness was concentration-dependent.

Skin penetration enhancement with isostearyl isostearate was evaluated in vitro using excised human abdominal skin by measuring the permeation of 5-fluorouracil through the skin after 6 h.[40] Both isostearyl isostearate and the buffer control increased the rate of penetration of 5-fluorouracil, but isostearyl isostearate was not a penetration enhancer.

The effect of alkyl esters on the penetration of indomethacin in vitro through excised hairless rat skin was examined.[41] The permeation of 1% indomethacin from suspensions and from hydrogenated phospholipid gels containing cetyl caprylate, ethylhexyl palmitate, isocetyl palmitate, isocetyl isostearate, or isocetyl stearate was determined. The permeation rate of indomethacin from the esters increases with increased solubility of the drug in the ester. The solubility of indomethacin in liquid paraffin is very low, and there was no permeation of indomethacin from liquid paraffin after 10 h. Permeation from the isocetyl isostearate suspension was 3.8 µg/cm^2 after 10 h; isocetyl isostearate was the alkyl ester tjat indomethacin was least soluble in, but in comparison to liquid paraffin, solubility was increased 60-fold. (Of the esters studied, indomethacin had the highest solubility in and permeation from ethylhexyl isononanoate, an alkyl ester previously reviewed by the CIR, with approximately 23 µg/cm^2 permeating in 10 h.) Permeation rates (and solubility) were higher in gels formed by a hydrogenated phospholipid than from suspensions. In all cases, a linear relationship existed between the cumulative amounts of indomethacin that permeated from any ester from 4 h to 10 h. In another study, the permeation rate of ketoprofen from an alkyl ester suspension through excised hairless rat skin was also proportional to its solubility in the suspension.[42]

ANIMAL TOXICOLOGY

Single-Dose (Acute) Toxicity

Dermal

Butyl Oleate

The acute dermal toxicity of butyl oleate was determined in rabbits.[43] A single dose of 5 g/kg bw butyl oleate was applied to the skin of 10 rabbits. Slight erythema was observed in 3 rabbits and moderate erythema in 7, and slight edema was observed in 6 rabbits and moderate edema in 3. None of the animals died, and the dermal LD_{50} of butyl oleate in rabbits was >5 g/kg bw. (Additional details were not provided).

Propylheptyl Caprylate

Groups of 5 male and 5 female Wistar rats were dosed dermally with a single semi-occlusive application of 0 or 2000 mg/kg bw propylheptyl caprylate, applied neat.[44] No irritation or treatment-related signs of toxicity were reported, and the dermal LD_{50} of propylheptyl caprylate was >2 g/kg bw.

Ethylhexyl Laurate

The dermal LD_{50} of ethylhexyl laurate in rats was >3 g/kg bw.[45] (Details were not provided).

Oral

Butyl Oleate

A group of 10 rats were dosed orally with 5 g/kg bw butyl oleate.[43] None of the animals died. The oral LD_{50} of butyl oleate in rats was >5 g/kg bw.

Cetyl Myristoleate

Five male and five female white rats were dosed orally with 5 g/kg bw cetyl myristoleate.[34] There was no mortality, and the LD_{50} was >5 g/kg bw.

Propylheptyl Caprylate

Six female Wistar rats were dosed orally with 2 g/kg bw propylheptyl caprylate in corn oil.[44] All animals had hunched posture and piloerection for 6 h after dosing, but none of the animals died during the study. The oral LD50 of propylheptyl caprylate was >2 mg/kg bw.

Ethylhexyl Laurate

The oral LD_{50} of ethylhexyl laurate in rats was >2 g/kg bw.[45] (Details were not provided).

Isodecyl Laurate

The oral LD_{50} of isodecyl laurate in Wistar rats was >13 g/kg bw (>15 ml/kg bw).[46] (Details were not provided).

Inhalation

Ethylhexyl Laurate

The inhalation LC_{50} of ethylhexyl laurate in rats was >230 ppm.[45] (Details were not provided).

Repeated-Dose Toxicity

Oral

Propylheptyl Caprylate

Groups of 10 male and 10 female CD/Crl:CD(SD) rats were dosed daily by gavage with 0, 100, 300, or 1000 mg/kg bw/day propylheptyl caprylate in soybean oil for 90 days.[44] No test-article related deaths occurred. No test-article related clinical signs of toxicity or changes in body weights or feed consumption, changes in the estrous cycle, or effects on sperm were observed, and there were no effects on any clinical chemistry or hematology parameters. A statistically significant decrease in the urinary pH values in males and females of the 300 and 1000 mg/kg bw/day groups was considered to be related to treatment. Absolute and relative liver weights were statistically significantly increased in animals of the high dose group. The change in urinary pH was attributed to the possibility of an acidic metabolite being eliminated in large doses, and the changes in liver weight were considered a non-specific adaptive change to the liver workload at the high does, therefore, the NOAEL was established as ≥1000 mg/mg bw/day propylheptyl caprylate.

Ethylhexyl Laurate

Male and female Sprague-Dawley rats, number per group not specified, were dosed with 0, 100, 300, or 1000 mg/kg bw ethylhexyl laurate once daily, 5 days/wk, by gavage for 28 days.[45] The no-observable adverse-effect level (NOAEL) was 1000 mg/kg bw. (No additional details were provided.)

Isodecyl Laurate

Male Wistar rats, number per group not specified, were dosed orally with 500, 1500, or 4500 mg/kg/day isodecyl laurate, 6 days/wk, for 4 wks.[46] No treatment related changes were observed at any dose level. (No additional details were provided).

GENOTOXICITY

In Vitro

Propylheptyl Caprylate

The mutagenic potential of 0.31, 0.62, 1.25, 2.5, and 5.0 µl/plate propylheptyl caprylate was evaluated in an Ames test, with and without metabolic activation, using *Salmonella. typhimurium* strains TA1535, TA1573, TA98, TA100, and TA102.[44] Dimethyl sulfoxide served as the vehicle. Propylheptyl caprylate was not mutagenic with or without metabolic activation.

An *in vitro* mammalian chromosomal aberration assay was performed in Chinese hamster V79 lung fibroblasts with 22.4-2480 µg/ml propylheptyl caprylate.[44] The exposure time was 4 h with metabolic activation and ranged from 4-28 h without metabolic activation. Propylheptyl caprylate was not clastogenic to Chinese hamster V79 lung fibroblasts.

Ethylhexyl Laurate

Ethylhexyl laurate, tested at doses 8, 40, 200, 1000, and 5000 µg/plate, was not mutagenic in an Ames test performed in *S. typhimurium* (strains not specified) with and without metabolic activation.[45]

Isodecyl Laurate

An Ames test was performed with 312-5000 µg/plate isodecyl laurate.[46] Isodecyl laurate was not mutagenic towards *S. typhimurium* strains TA97, TA98, TA100, and TA102. (No additional details were provided).

In Vivo

Ethylhexyl Laurate

A mouse micronucleus test was performed in which male and female mice were dosed by gavage with 0, 1.25, 2.5, and 5.0 ml/kg ethylhexyl laurate.[45] The animals were killed after 4, 48, or 72 h. Ethylhexyl laurate was not genotoxic in this assay.

CARCINOGENICITY

Published carcinogenicity data were not found.

IRRITATION AND SENSITIZATION

Dermal irritation and sensitization studies are summarized in Table 11.

Mixed results were reported in irritation testing in both non-human and human testing with some alkyl esters. In rabbits, propylheptyl caprylate was moderately irritating[44] and ethylhexyl laurate was not irritating.[45] A formulation containing 10% isopropyl palmitate was moderately irritating in male hairless guinea pigs.[38] In one study in which it was unclear from the report whether the testing was done in rats or in rabbits, 30% isodecyl laurate in liquid paraffin was not a dermal irritant.[46] Propylheptyl caprylate, which was moderately irritating in rabbit skin, was not irritating to human skin when applied for 48-h using an occlusive patch.[44] In other clinical tests, patch testing with isopropyl myristate resulted in 3/244 positive reactions in subjects with suspected contact dermatitis[47] and a formulation containing 10% isopropyl palmitate, which was moderately irritating to guinea pig skin, was well tolerated in a human chamber scarification test.[38] Undiluted and 50% 2-ethylhexyl esters of C8-14 fatty acids applied openly for 60 min and 25% and 50% applied with an occlusive 24-h patch were not irritating, but undiluted 2-ethylhexyl esters of C8-14 fatty acids produced slight erythema and moderate edema when applied with an occlusive 24-h patch.[45]

The alkyl esters were not sensitizers in non-human or human studies. In a mouse local lymph node assay, propylheptyl caprylate did not induce a lymphocyte proliferative response, indicating that it is not a sensitizer.[44] Ethylhexyl laurate[45] and isodecyl laurate[46] were not sensitizers in a guinea pig maximization test. In clinical testing, butyl oleate was not a sensitizer in a maximization study[48] and a body oil containing 77.9% ethylhexyl palmitate,[49] a lip gloss containing 25.9% ethylhexyl stearate,[50] an eyebrow pencil formulation containing 38.8% ethylhexyl stearate,[51] a concealer containing 29.5% isocetyl myristate,[52] and a lipstick formulation containing 15.2% cetyl ricinoleate[53] were not sensitizers in human repeat insult patch tests (HRIPTs).

Ocular Irritation

Propylheptyl Caprylate

The ocular irritation potential of propylheptyl caprylate was evaluated in 3 female rabbits.[44] Slight conjunctival irritation was observed in all animals 1 h after instillation, and the irritation had increased to a more diffuse response in one animal at 24 h after instillation. All effects subsided within 72 h for two of the animals and by 7 days in the third animal. Propylheptyl caprylate was considered slightly irritating to rabbit eyes.

Ethylhexyl Laurate

Ethylhexyl laurate was not irritating to rabbit eyes.[45] (Details not provided).

Isodecyl Laurate

A study was conducted in New Zealand White rabbits to determine the ocular irritation potential of 10% isodecyl laurate in liquid paraffin.[46] No significant treatment-related ocular lesions were observed. (No additional details were provided).

MISCELLANEOUS EFFECTS

Dermal Effects

Isostearyl Isostearate

In a clinical study, a determination of skin surface water loss, measured using a plastic occlusion stress test, indicated that isostearyl isostearate (2 mg/cm^2, applied neat) improved the stratum corneum water permeability barrier function.[54] The researchers hypothesize that the improvement was due to effects on stratum corneum lipid phase behavior.

SUMMARY

The cosmetic ingredient named cetyl esters has been reviewed previously by the Cosmetic Ingredient Review (CIR) Expert Panel, and in 1997 the Panel concluded that cetyl esters was safe as used in cosmetics. Cetyl esters is a member of a broader group of 237 cosmetic ingredients, the alkyl esters. These ingredients consist of the reaction products of fatty acids and alcohols, and the core relationship between these ingredients is a carboxyl ester functional group flanked on both sides by alkyl chains. Some of these alkyl chains are straight and some are branched. Although 57 of the alkyl esters have been reviewed previously by the CIR, all are being included as ingredients in this safety assessment due to their structural and functional similarities. Information from the original reports on the previously reviewed alkyl esters is summarized in Table 2 of this report; because this information can be found in published documents, it is not included in the text or Summary section of this document. Ingredients included in the safety assessment are primarily reported to function in cosmetics as skin conditioning agents.

Most of these alkyl esters are produced synthetically via classical Fischer type esterification methods. However, some of the natural source ingredients in this review may be produced by transesterification. Alkyl esters are hydrophobic materials that range from oils at the lowest molecular weights/shortest chain- lengths to waxy solids at the highest molecular weights/longest chain-lengths.

VCRP data obtained from the FDA in 2013 and data received in response to a survey of the maximum reported use concentration by category conducted by the Personal Care Products Council indicate that 112 of the 237 alkyl esters named in this safety assessment are used in cosmetic formulations. Ethylhexyl palmitate has the most reported uses, 1525, followed by isopropyl myristate, 1182 reported uses, and isopropyl palmitate, 1125 reported uses. Ethylhexyl palmitate had the highest reported use concentration, 78% in body and hand preparations, followed by isopropyl myristate, which is used at 77.3% in other hair grooming aids and 76.6% in aerosol hair spray formulations. Isoamyl laurate and butyl stearate are approved as a direct food additives and a number of the alkyl esters are approved as indirect food additives.

In rats fed a diet containing 20% cetyl oleate, absorption of cetyl oleate was reported to be 75.3%. All the animals developed seborrhea. The absorbability and seborrhea suggested that cetyl oleate was not hydrolyzed in the gut.

Isopropyl myristate is a non-polar penetration enhancer in pharmaceutical and cosmetic preparations. Isopropyl palmitate is reported to be used in topical formulations as a lipid layer penetration enhancer. Isostearyl isostearate increased the rate of penetration of fluorouracil through excised human abdominal skin, but it was not a penetration enhancer. Alkyl esters tended to increase the permeation rate of indomethacin and ketoprofen; the increase occurred due to increased solubility.

The dermal LD_{50} of butyl oleate in rabbits was >5 g/kg, and the dermal LD_{50} in rats of propylheptyl caprylate and ethylhexyl laurate was >2 and >3 g/kg/bw, respectively. The oral LD_{50} in rats was >5 g/kg for butyl oleate and for cetyl myristoleate, >2 g/kg for propylheptyl caprylate and ethylhexyl laurate, >13 g/kg for isodecyl oleate, and >64 cc/kg for isopropyl linoleate. The inhalation LC_{50} of ethylhexyl laurate in rats was >230 ppm. In repeated dose studies in rats, toxic effects were not observed with oral administration of up to 1000 mg/kg ethylhexyl laurate or 4500 mg/kg/day isodecyl laurate for 4 wks or with up to 1000 mg/kg bw/day propylheptyl caprylate for 90 days.

Propylheptyl caprylate was not mutagenic in an Ames assay (≤5.0 µl/plate) or clastogenic in an *in vitro* mammalian chromosomal aberration assay (≤2480 µg/ml). Ethylhexyl laurate and isodecyl laurate were not mutagenic towards *S. typhimurium* in an Ames assay at doses of ≤5000 µg/plate, and ethylhexyl laurate, ≤5.0 ml/kg, was not genotoxic in a mouse micronucleus test.

Mixed results were reported in non-human irritation testing using some alkyl esters. In rabbits, propylheptyl caprylate was moderately irritating and ethylhexyl laurate was not irritating. A formulation containing 10% isopropyl palmitate was moderately irritating in male hairless guinea pigs. In one study in which it was unclear from the report whether the testing was done in rats or in rabbits, isodecyl laurate was not irritating to the skin. In a mouse local lymph node assay, propylheptyl caprylate did not induce a lymphocyte proliferative response, indicating that it is not a sensitizer. Ethylhexyl laurate and isodecyl laurate were not sensitizers in a guinea pig maximization test.

Mixed irritation results were also observed in human studies. Propylheptyl caprylate, which was moderately irritating in rabbit skin, was not irritating to human skin when applied for 48-h using an occlusive patch. Patch testing with isopropyl myristate resulted in 3/244 positive reactions in subjects with suspected contact dermatitis. A formulation containing 10% isopropyl palmitate, which was moderately irritating to guinea pig skin, was well tolerated in a human chamber scarification test. Undiluted and 50% 2-ethylhexyl esters of C8-14 fatty acids applied openly for 60 min and 25 and 50% applied with an occlusive 24-h patch were not irritating, but undiluted 2-ethylheyxl esters of C8-14 fatty acids produced slight erythema and moderate edema when applied with an occlusive 24-h patch. No sensitization reactions were observed in human studies. Butyl oleate was not a sensitizer in a maximization study and a body oil containing 77.9% ethylhexyl palmitate, a lip gloss containing 25.9% ethylhexyl stearate, an eyebrow pencil formulation containing 38.8% ethylhexyl stearate, a concealer containing 29.5% isocetyl myristate, and a lipstick formulation containing 15.2% cetyl ricinoleate were not sensitizers in HRIPTs.

Ocular irritation studies were performed using rabbits. Cetyl esters, 60-65%, ethylhexyl laurate, 10% isodecyl laurate in liquid paraffin, and 10% isopropyl laurate in corn oil were not irritating to rabbit eyes and undiluted and 10% aq. isopropyl linoleate and propylheptyl caprylate was slightly irritating to rabbit eyes.

DISCUSSION

This CIR Expert Panel expanded its earlier safety assessment of cetyl esters to include all alkyl esters currently described as cosmetic ingredients based on similarities in molecular structures, physical and chemical properties, and usage in cosmetics. These ingredients consist of the reaction products of fatty acids and alcohols.

Although there are data gaps for individual ingredients, there are adequate data on many of the ingredients, and the relatedness of molecular structures, physicochemical properties, and functions and concentrations in cosmetics noted above allowed grouping these ingredients together and extending the available toxicological data to support the safety of the entire group. For example, dermal absorption and metabolism data for certain long-chain, branched alkyl esters were lacking. The consensus of the Panel was that earlier safety assessments had determined that dermal penetration of long-chain alcohols is predicted to be low, so the Panel extended that information to suggest that dermal penetration for alkyl esters is likely to be even lower. The Panel recognized that some of the alkyl esters can enhance the penetration of other ingredients through the skin. The Panel cautioned that care should be taken in formulating cosmetic products that may contain these ingredients in combination with any ingredients whose safety was based on their lack of dermal absorption data, or when dermal absorption was a concern.

The Panel acknowledged that some of the alkyl esters may be formed from plant-derived or animal-derived acid or alcohol constituents. The Panel thus expressed concern regarding pesticide residues and heavy metal that may be present in botanical ingredients. They stressed that the cosmetics industry should continue to use the necessary procedures to sufficiently limit amounts of such impurities in an ingredient before blending them into cosmetic formulations. Additionally, the Panel considered the dangers inherent in using animal-derived ingredients, namely the transmission of infectious agents. While tallow may be used in the manufacture of some ingredients in this safety assessment and is clearly animal-derived, the Panel notes that tallow is highly processed, and tallow derivatives even more so. The Panel agrees with determinations by the U.S. FDA that tallow derivatives are not risk materials for transmission of infectious agents.

The Panel was also concerned that the potential exists for dermal irritation with the use of products formulated using some of the alkyl esters. The Panel thus specified that products must be formulated to be non-irritating.

Although a previous CIR safety assessment on isopropyl linoleate determined that the data were insufficient to determine safety for use in cosmetics and that human irritation and sensitization data and genotoxicity data were needed, the Panel reexamined that finding. Because it is now stated that products containing alkyl esters must be formulated to be non-irritating, irritation data are no longer needed for isopropyl linoleate. Sensitization data were available for other alkyl esters, suggesting that sensitization would not be a concern for the isopropyl linoleate. Likewise, the Panel concluded that the genotoxicity data were available on a number of structurally analogous compounds, suggesting an absence of genotoxicity for isopropyl linoleate.

The Panel also noted that although no carcinogenicity data were available, the negative genotoxicity data coupled with the fact that dermal penetration is expected to be low led the Panel to conclude that carcinogenicity would not be a concern with cosmetic use.

The Panel discussed the issue of incidental inhalation exposure to alkyl esters from powders and products that may be aerosolized. Some of the alkyl esters are reportedly used at up to 19% in products that may become airborne, (i.e., in face powders), and at quite high concentrations in cosmetic products that may be aerosolized, (e.g., 77% isopropyl myristate in hair sprays, 45% ethylhexyl palmitate in indoor tanning preparations, and 23% isopropyl myristate in deodorant formulations). There were no repeated-dose inhalation toxicity data available for the alkyl esters; however, the actual exposure in the breathing zone is small and given 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. Also, these ingredients are large molecules and most are quite insoluble in water, which supports the view that they are unlikely to be absorbed or cause local effects in the respiratory tract. The Panel also considered the data available to characterize the potential for alkyl esters to cause systemic toxicity, irritation, sensitization, or other effects, and concluded that ingredients of this family tend not to produce systemic toxicity at high doses in single-dose oral, dermal, or inhalation studies and not to produce significant systemic toxicity in oral repeated-dose studies. A detailed discussion and summary of the Panel's approach to evaluating incidental inhalation exposures to ingredients in cosmetic products that may be aerosolized is available at http://www.cir-safety.org/cir-findings.

CONCLUSION

The CIR Expert Panel concluded that the alkyl esters, listed below, are safe in the present practices of use and concentration described in this safety assessment when formulated to be non-irritating.

Arachidyl Behenate
Arachidyl Erucate*
Arachidyl Propionate
Batyl Isostearate*
Batyl Stearate*
Behenyl Beeswax
Behenyl Behenate
Behenyl Erucate
Behenyl Isostearate*
Behenyl Olivate
Behenyl/Isostearyl Beeswax*
Butyl Avocadate
Butyl Babassuate*
Butyl Isostearate*
Butyl Myristate
Butyl Oleate*
Butyl Stearate
Butyloctyl Beeswax*
Butyloctyl Behenate*
Butyloctyl Candelillate*
Butyloctyl Cetearate*

Butyloctyl Oleate*
Butyloctyl Palmitate*
C10-40 Isoalkyl Acid
Octyldodecanol Esters*
C14-30 Alkyl Beeswax*
C16-36 Alkyl Stearate*
C18-38 Alkyl Beeswax*
C18-38 Alkyl C24-54 Acid Ester*
C20-40 Alkyl Behenate*
C20-40 Alkyl Stearate
C30-50 Alkyl Beeswax*
C30-50 Alkyl Stearate*
C32-36 Isoalkyl Stearate*
C40-60 Alkyl Stearate*
C4-5 Isoalkyl Cocoate*
Caprylyl Butyrate*
Caprylyl Caprylate
Caprylyl Eicosenoate
Cetearyl Behenate
Cetearyl Candelillate
Cetearyl Isononanoate
Cetearyl Nonanoate*
Cetearyl Olivate
Cetearyl Palmate*
Cetearyl Palmitate*
Cetearyl Rice Branate*
Cetearyl Stearate
Cetyl Babassuate
Cetyl Behenate*
Cetyl Caprate
Cetyl Caprylate
Cetyl Dimethyloctanoate*
Cetyl Esters
Cetyl Isononanoate*
Cetyl Laurate
Cetyl Myristate
Cetyl Myristoleate*
Cetyl Oleate*
Cetyl Palmitate
Cetyl Ricinoleate
Cetyl Stearate
Cetyl Tallowate
Chimyl Isostearate*
Chimyl Stearate*
Coco-Caprylate
Coco-Caprylate/Caprate
Coco-Rapeseedate*
Decyl Castorate*
Decyl Cocoate
Decyl Isostearate*
Decyl Jojobate*
Decyl Laurate*
Decyl Myristate*
Decyl Oleate
Decyl Olivate
Decyl Palmitate*
Decyltetradecyl Cetearate*
Erucyl Arachidate*
Erucyl Erucate*
Erucyl Oleate*
Ethylhexyl Adipate/Palmitate/Stearate*
Ethylhexyl C10-40 Isoalkyl Acidate*
Ethylhexyl Cocoate
Ethylhexyl Hydroxystearate
Ethylhexyl Isononanoate
Ethylhexyl Isopalmitate
Ethylhexyl Isostearate
Ethylhexyl Laurate
Ethylhexyl Myristate
Ethylhexyl Neopentanoate*
Ethylhexyl Oleate*
Ethylhexyl Olivate
Ethylhexyl Palmitate
Ethylhexyl Pelargonate
Ethylhexyl Stearate
Heptyl Undecylenate
Heptylundecyl Hydroxystearate
Hexyl Isostearate
Hexyl Laurate
Hexyldecyl Hexyldecanoate*
Hexyldecyl Isostearate
Hexyldecyl Laurate
Hexyldecyl Oleate*
Hexyldecyl Palmitate*
Hexyldecyl Stearate
Hexyldodecyl/Octyldecyl Hydroxystearate*
Hydrogenated Castor Oil Behenyl Esters*
Hydrogenated Castor Oil Cetyl Esters *
Hydrogenated Castor Oil Stearyl Esters*
Hydrogenated Ethylhexyl Olivate
Hydrogenated Ethylhexyl Sesamate*
Hydrogenated Isocetyl Olivate*
Hydrogenated Isopropyl Jojobate*
Hydroxycetyl Isostearate*
Hydroxyoctacosanyl Hydroxystearate
Isoamyl Laurate
Isobutyl Myristate*
Isobutyl Palmitate*
Isobutyl Perlargonate*
Isobutyl Stearate*
Isobutyl Tallowate*
Isocetyl Behenate
Isocetyl Isodecanoate*
Isocetyl Isostearate*
Isocetyl Laurate*
Isocetyl Myristate
Isocetyl Palmitate
Isocetyl Stearate
Isodecyl Cocoate
Isodecyl Hydroxystearate*
Isodecyl Isononanoate
Isodecyl Laurate
Isodecyl Myristate
Isodecyl Neopentanoate
Isodecyl Oleate
Isodecyl Palmitate*
Isodecyl Stearate*
Isohexyl Caprate
Isohexyl Laurate*
Isohexyl Neopentanoate*
Isohexyl Palmitate*
Isolauryl Behenate*
Isononyl Isononanoate
Isooctyl Caprylate/Caprate*
Isooctyl Tallate*
Isopropyl Arachidate*
Isopropyl Avocadate*
Isopropyl Babassuate*
Isopropyl Behenate*
Isopropyl Hydroxystearate
Isopropyl Isostearate
Isopropyl Jojobate
Isopropyl Laurate*
Isopropyl Linoleate
Isopropyl Myristate
Isopropyl Oleate*
Isopropyl Palmitate
Isopropyl Ricinoleate
Isopropyl Stearate
Isopropyl Tallowate*
Isostearyl Avocadate
Isostearyl Behenate
Isostearyl Erucate*
Isostearyl Hydroxystearate
Isostearyl Isononanoate
Isostearyl Isostearate
Isostearyl Laurate
Isostearyl Linoleate
Isostearyl Myristate
Isostearyl Neopentanoate
Isostearyl Palmitate
Isotridecyl Isononanoate
Isotridecyl Laurate*
Isotridecyl Myristate*
Isotridecyl Stearate
Lauryl Behenate*
Lauryl Cocoate*
Lauryl Isostearate*
Lauryl Laurate
Lauryl Myristate*
Lauryl Oleate
Lauryl Palmitate
Lauryl Stearate
Lignoceryl Erucate*
Myristyl Isostearate*
Myristyl Laurate
Myristyl Myristate
Myristyl Neopentanoate
Myristyl Stearate
Octyldecyl Oleate*
Octyldodecyl Avocadoate*
Octyldodecyl Beeswax*
Octyldodecyl Behenate*
Octyldodecyl Cocoate*
Octyldodecyl Erucate
Octyldodecyl Hydroxystearate*
Octyldodecyl Isostearate
Octyldodecyl Meadowfoamate*
Octyldodecyl Myristate
Octyldodecyl Neodecanoate*

Octyldodecyl Neopentanoate
Octyldodecyl Octyldodecanoate
Octyldodecyl Oleate*
Octyldodecyl Olivate
Octyldodecyl Ricinoleate
Octyldodecyl Safflowerate*
Octyldodecyl Stearate
Oleyl Arachidate*
Oleyl Erucate
Oleyl Linoleate
Oleyl Myristate*
Oleyl Oleate
Oleyl Stearate*
Propylheptyl Caprylate
Stearyl Beeswax
Stearyl Behenate*
Stearyl Caprylate
Stearyl Erucate*
Stearyl Heptanoate
Stearyl Linoleate*
Stearyl Olivate
Stearyl Palmitate
Stearyl Stearate
Tetradecyleicosyl Stearate*
Tetradecyloctadecyl Behenate*
Tetradecyloctadecyl Hexyldecanoate*
Tetradecyloctadecyl Myristate*
Tetradecyloctadecyl Stearate
Tetradecylpropionates*
Tridecyl Behenate*
Tridecyl Cocoate*
Tridecyl Erucate*
Tridecyl Isononanoate
Tridecyl Laurate*
Tridecyl Myristate*
Tridecyl Neopentanoate
Tridecyl Stearate

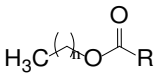
*Not in current use. Were ingredients in this group not in current use to be used in the future, the expectation is that they would be used in product categories and at concentrations comparable to others in this group.

FIGURES

Figure 1. Figures ordered by chain length, chemical structure

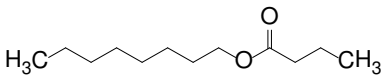
Structures, straight chain alkyl ingredients by total length

1. Cetyl Esters

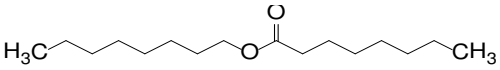


wherein R is an alkyl chain 13 to 17 carbons long and n is 13 to 17

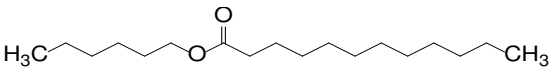
2. Caprylyl Butyrate



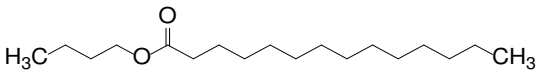
3. Caprylyl Caprylate



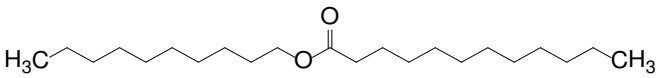
4. Hexyl Laurate



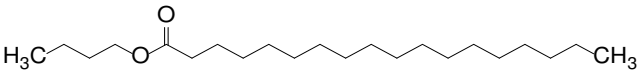
5. Butyl Myristate



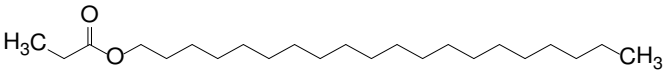
6. Decyl Laurate



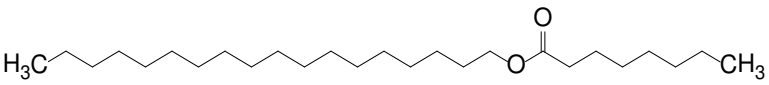
7. Butyl Stearate



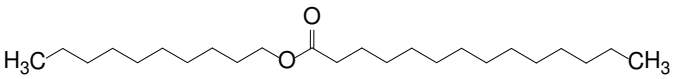
8. Arachidyl Propionate



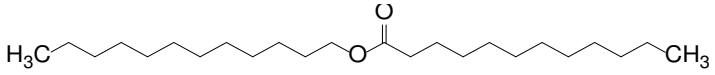
9. Stearyl Caprylate



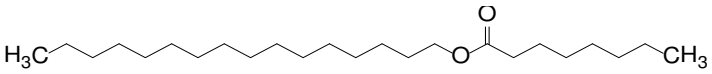
10. Decyl Myristate



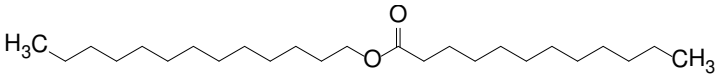
11. **Lauryl Laurate**



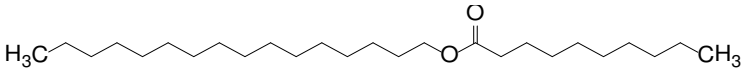
12. **Cetyl Caprylate**



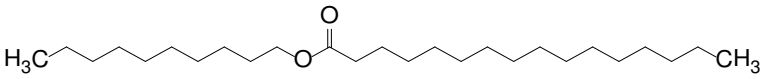
13. **Tridecyl Laurate**



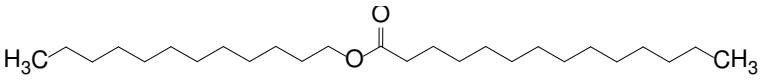
14. **Cetyl Caprate**



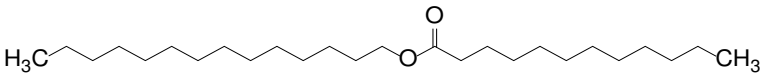
15. **Decyl Palmitate**



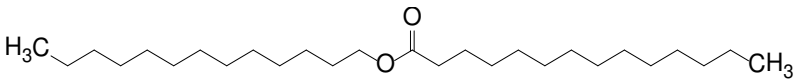
16. **Lauryl Myristate**



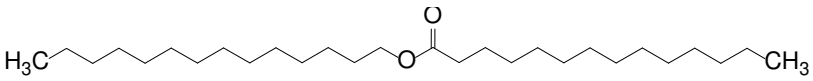
17. **Myristyl Laurate**



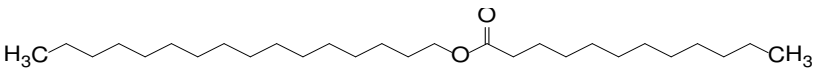
18. **Tridecyl Myristate**



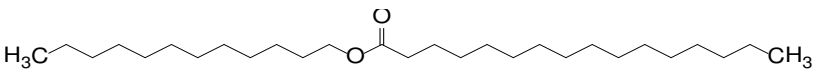
19. **Myristyl Myristate**



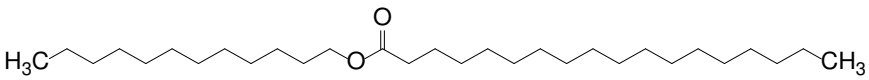
20. **Cetyl Laurate**



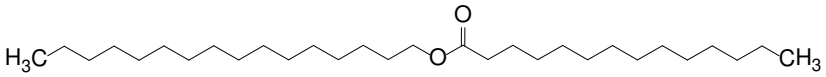
21. **Lauryl Palmitate**



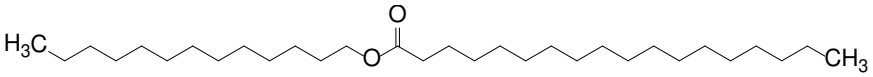
22. **Lauryl Stearate**



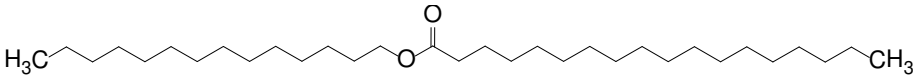
23. **Cetyl Myristate**



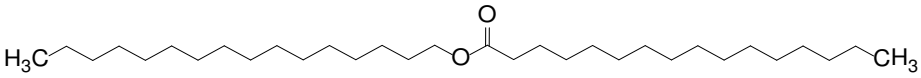
24. **Tridecyl Stearate**



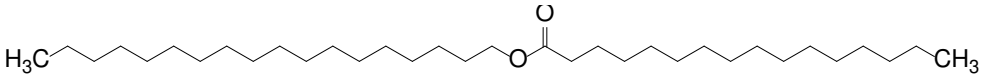
25. **Myristyl Stearate**



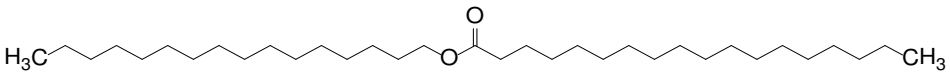
26. **Cetyl Palmitate**



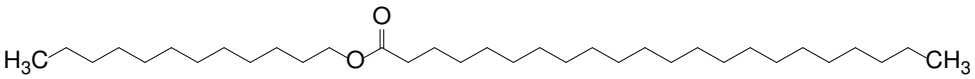
27. **Stearyl Palmitate**



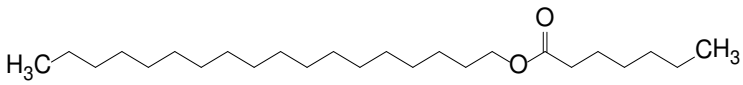
28. **Cetyl Stearate**



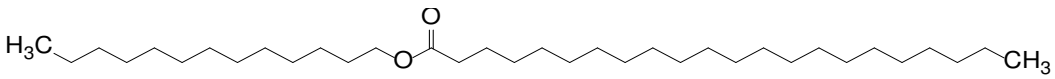
29. **Lauryl Behenate**



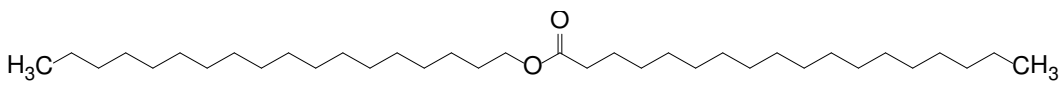
30. **Stearyl Heptanoate**



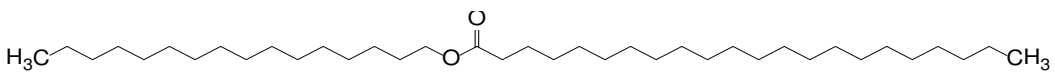
31. **Tridecyl Behenate**



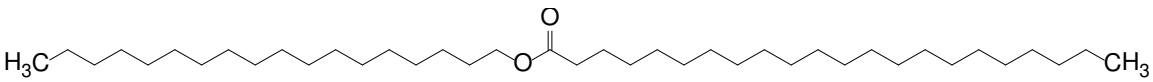
32. **Stearyl Stearate**



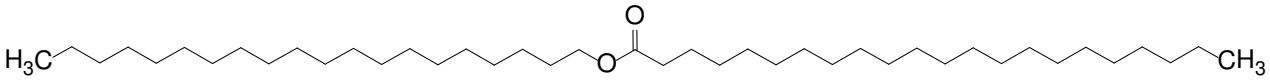
33. **Cetyl Behenate**



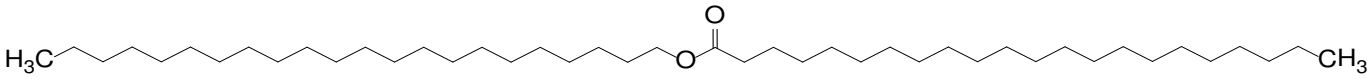
34. **Stearyl Behenate**



35. **Arachidyl Behenate**

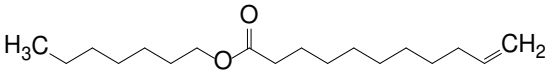


36. Behenyl Behenate

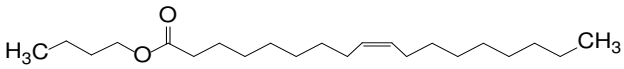


Unsaturated Straight chain

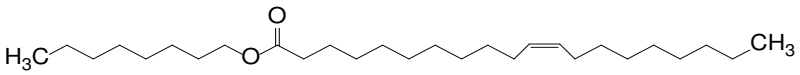
37. Heptyl Undecylenate



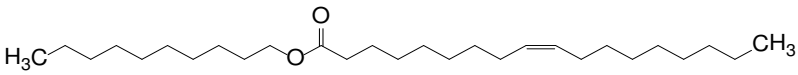
38. Butyl Oleate



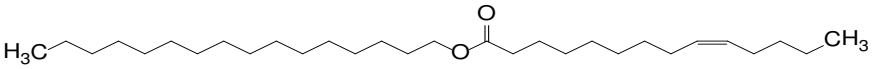
39. Caprylyl Eicosenoate



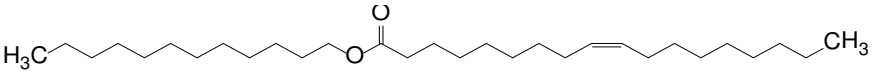
40. Decyl Oleate



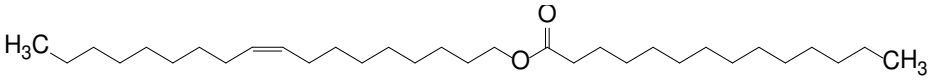
41. Cetyl Myristoleate



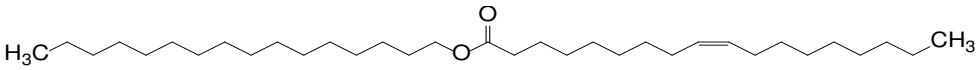
42. Lauryl Oleate



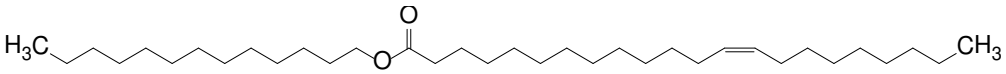
43. Oleyl Myristate



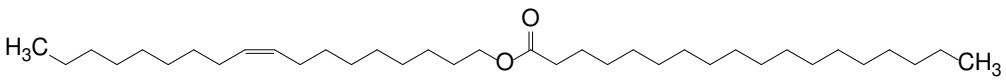
44. Cetyl Oleate



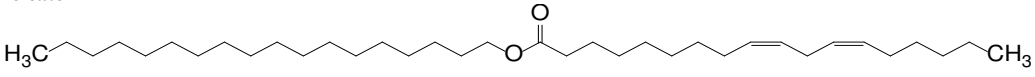
45. Tridecyl Erucate



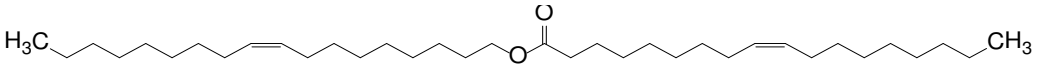
46. Oleyl Stearate



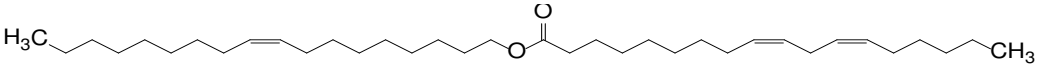
47. Stearyl Linoleate



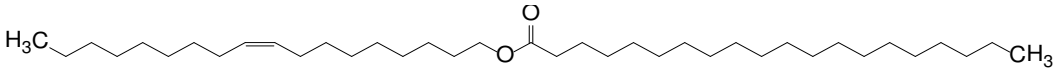
48. **Oleyl Oleate**



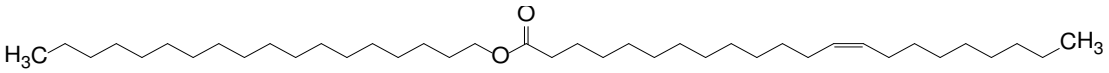
49. **Oleyl Linoleate**



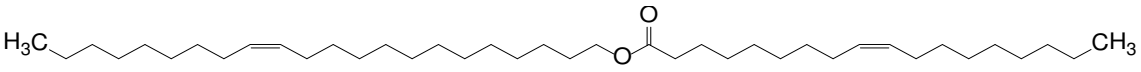
50. **Oleyl Arachidate**



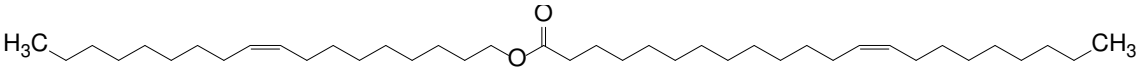
51. **Stearyl Erucate**



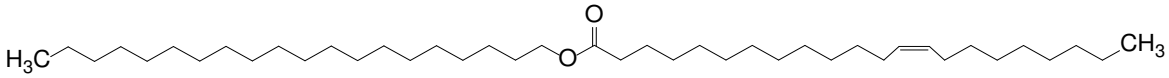
52. **Erucyl Oleate**



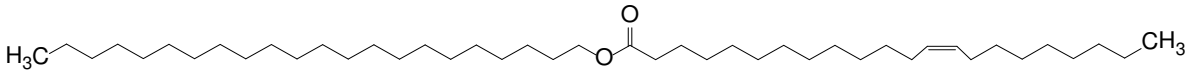
53. **Oleyl Erucate**



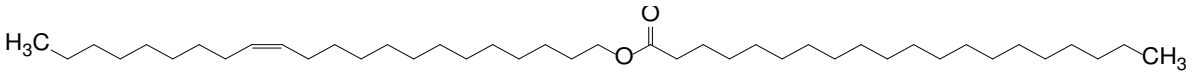
54. **Arachidyl Erucate**



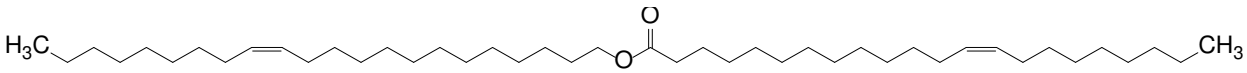
55. **Behenyl Erucate**



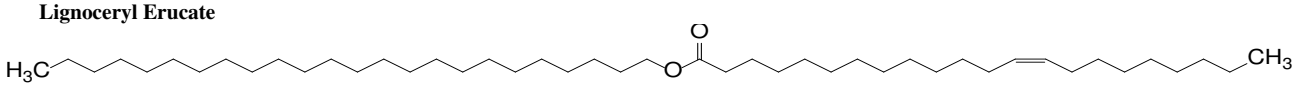
56. **Erucyl Arachidate**



57. **Erucyl Erucate**

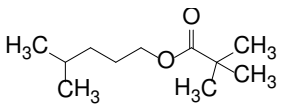


58. **Lignoceryl Erucate**

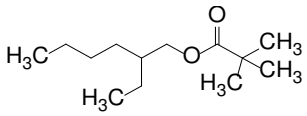


Branched, by longest length

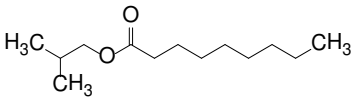
59. **Isohexyl Neopentanoate (one example of an "iso")**



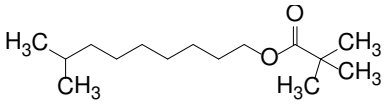
60. Ethylhexyl Neopentanoate



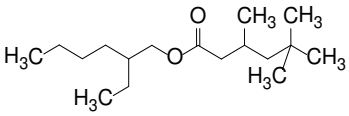
61. Isobutyl Pelargonate



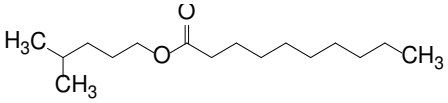
62. Isodecyl Neopentanoate (one example of an "iso")



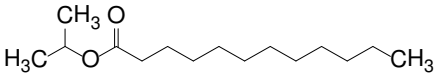
63. Ethylhexyl Isononanoate (one example of an "iso")



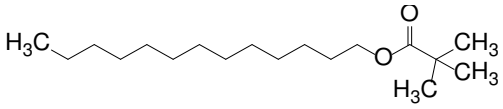
64. Isohexyl Caprate (one example of an "iso")



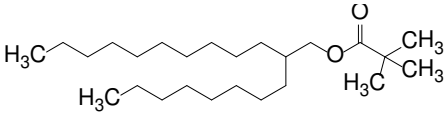
65. Isopropyl Laurate



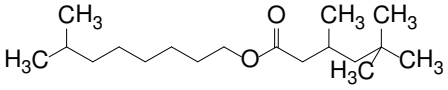
66. Tridecyl Neopentanoate



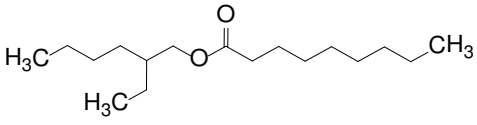
67. Octyldodecyl Neopentanoate



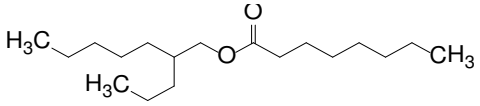
68. Isononyl Isononanoate (one example of an "iso")



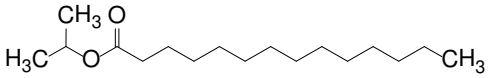
69. Ethylhexyl Pelargonate



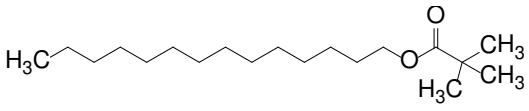
70. **Propylheptyl Caprylate**



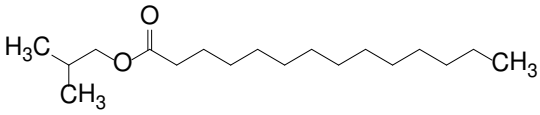
71. **Isopropyl Myristate**



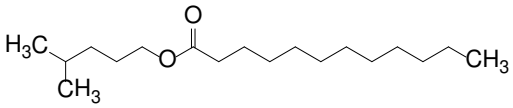
72. **Myristyl Neopentanoate**



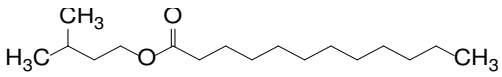
73. **Isobutyl Myristate**



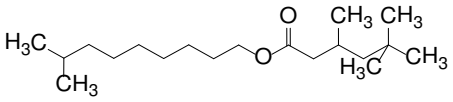
74. **Isohexyl Laurate (one example of an "iso")**



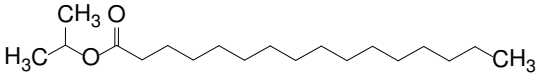
75. **Isoamyl Laurate**



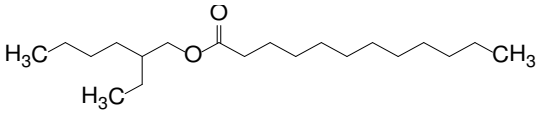
76. **Isodecyl Isononanoate (one example of an "iso")**



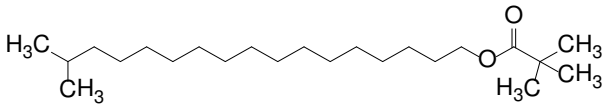
77. **Isopropyl Palmitate**



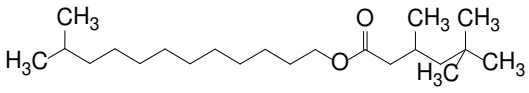
78. **Ethylhexyl Laurate**



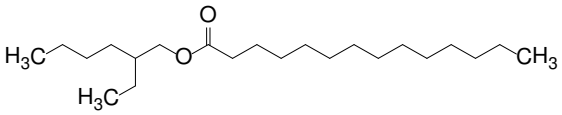
79. **Isostearyl Neopentanoate (one example of an "iso")**



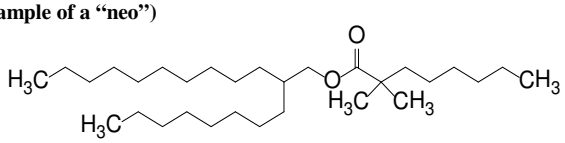
80. **Isotridecyl Isononanoate (one example of an "iso")**



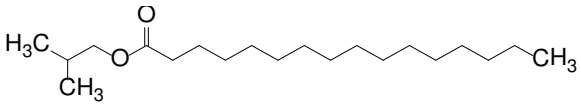
81. **Ethylhexyl Myristate**



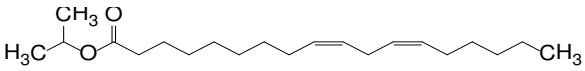
82. **Octyldodecyl Neodecanoate (one example of a "neo")**



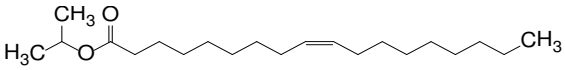
83. **Isobutyl Palmitate**



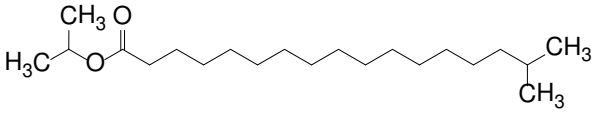
84. **Isopropyl Linoleate**



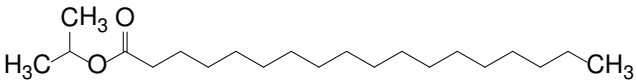
85. **Isopropyl Oleate**



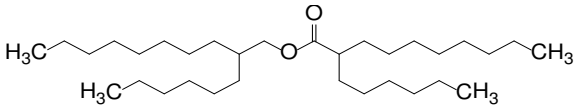
86. **Isopropyl Isostearate (one example of an "iso")**



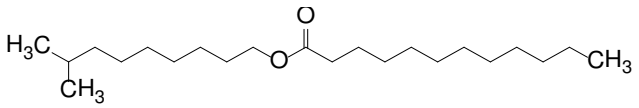
87. **Isopropyl Stearate**



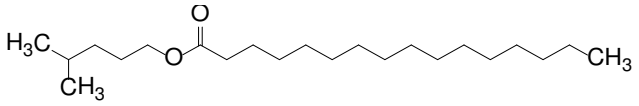
88. **Hexyldecyl Hexyldecanoate**



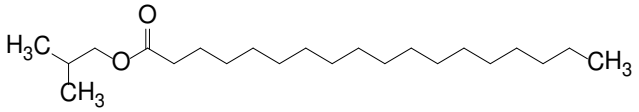
89. **Isodecyl Laurate (one example of an "iso")**



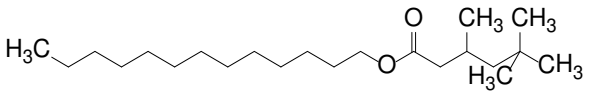
90. **Isohexyl Palmitate (one example of an "iso")**



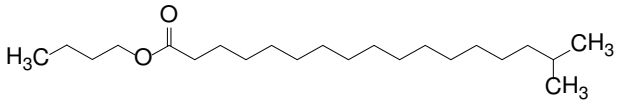
91. **Isobutyl Stearate**



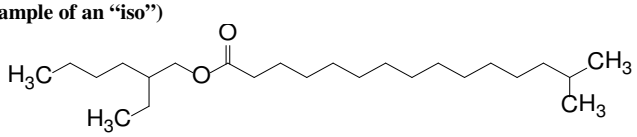
92. **Tridecyl Isononanoate (one example of an "iso")**



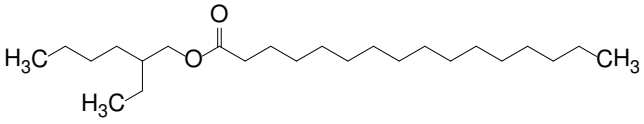
93. **Butyl Isostearate (one example of an "iso")**



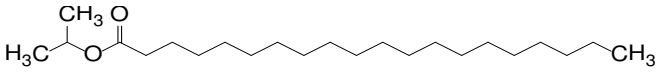
94. **Ethylhexyl Isopalmitate (one example of an "iso")**



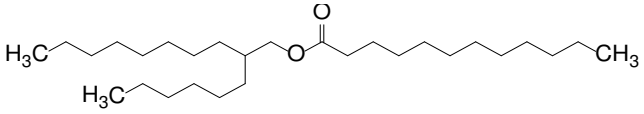
95. **Ethylhexyl Palmitate**



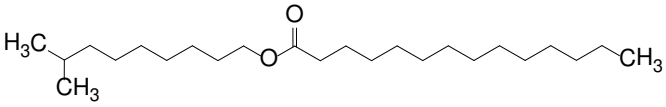
96. **Isopropyl Arachidate**



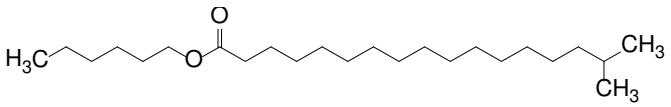
97. **Hexyldecyl Laurate**



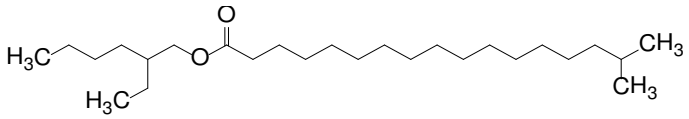
98. **Isodecyl Myristate (one example of an "iso")**



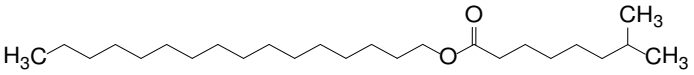
99. **Hexyl Isostearate (one example of an "iso")**



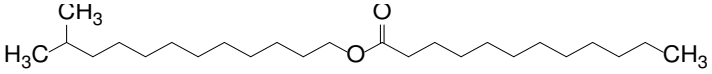
100. Ethylhexyl Isostearate (one example of an "iso")



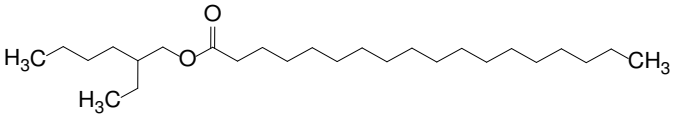
101. Cetyl Isononanoate (one example of an "iso")



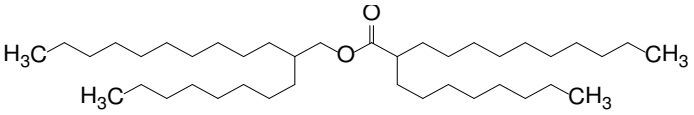
102. Isotridecyl Laurate (one example of an "iso")



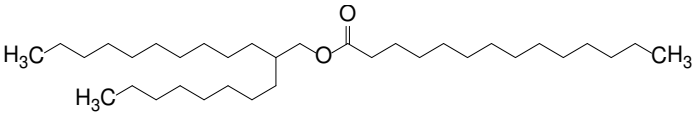
103. Ethylhexyl Stearate



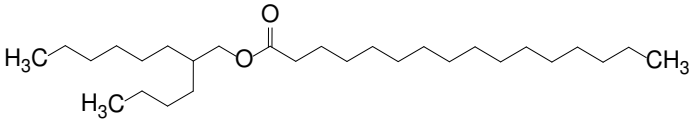
104. Octyldodecyl Octyldodecanoate



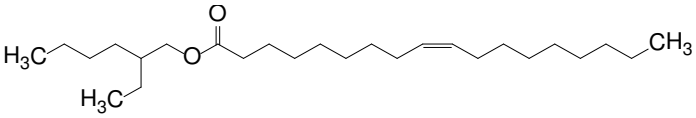
105. Octyldodecyl Myristate



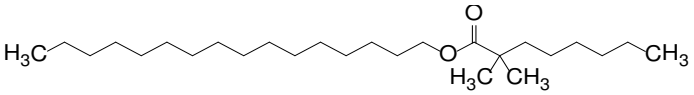
106. Butyloctyl Palmitate



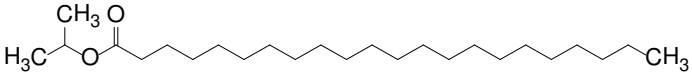
107. Ethylhexyl Oleate



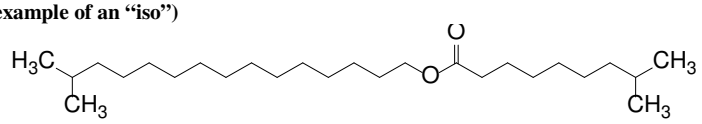
108. Cetyl Dimethyloctanoate



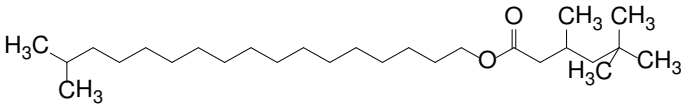
109. Isopropyl Behenate



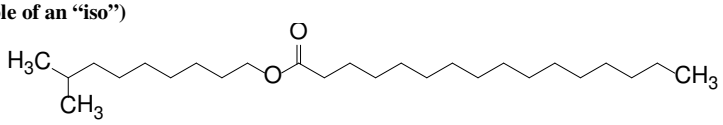
110. Isocetyl Isodecanoate (one example of an "iso")



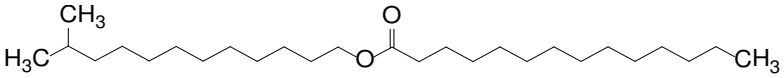
111. Isostearyl Isononanoate (one example of an "iso")



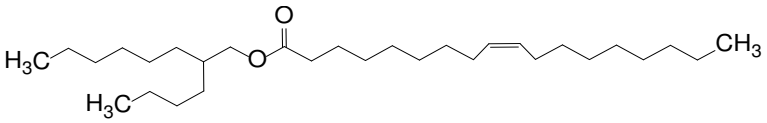
112. Isodecyl Palmitate (one example of an "iso")



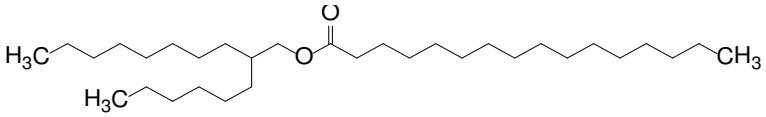
113. Isotridecyl Myristate (one example of an "iso")



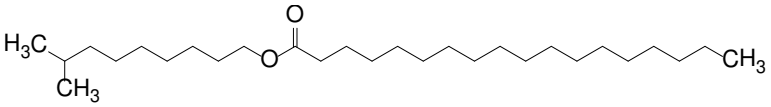
114. Butyloctyl Oleate



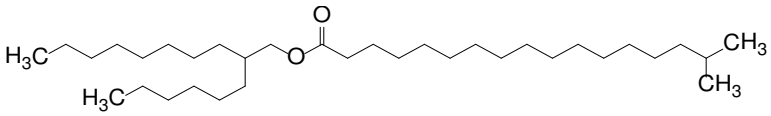
115. Hexyldecyl Palmitate



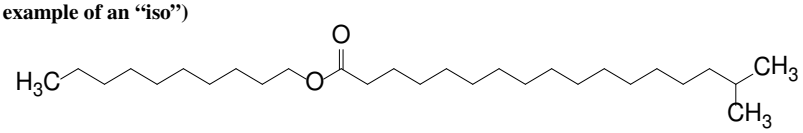
116. Isodecyl Stearate (one example of an "iso")



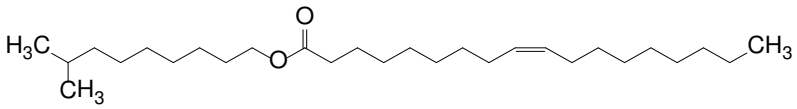
117. Hexyldecyl Isostearate (one example of an "iso")



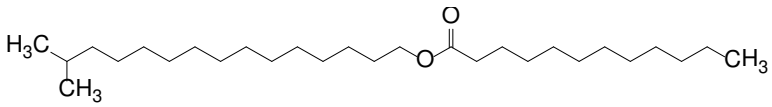
118. Decyl Isostearate (one example of an "iso")



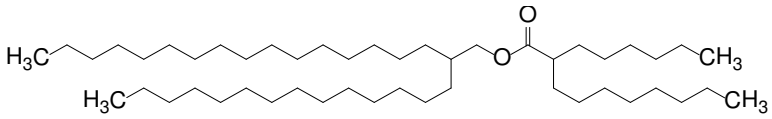
119. Isodecyl Oleate (one example of an "iso")



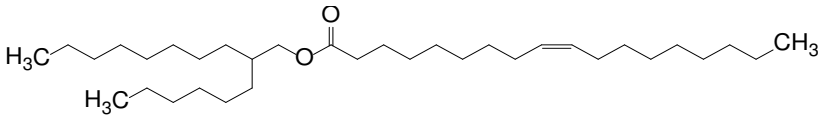
120. Isocetyl Laurate (one example of an "iso")



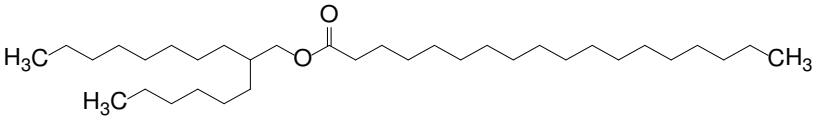
121. Tetradecyloctadecyl Hexyldecanoate



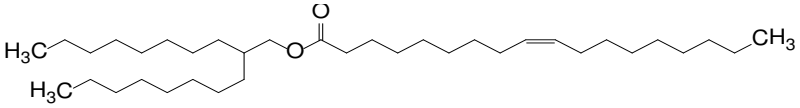
122. Hexyldecyl Oleate



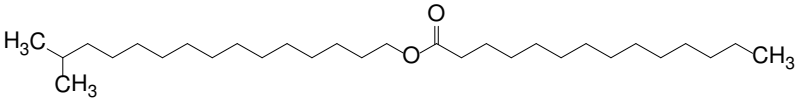
123. Hexyldecyl Stearate



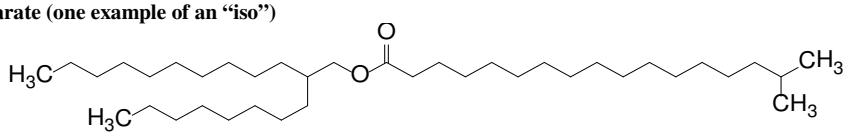
124. Octyldecyl Oleate



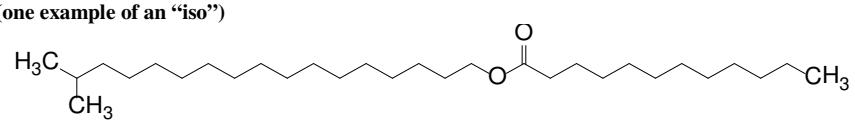
125. Isocetyl Myristate (one example of an "iso")



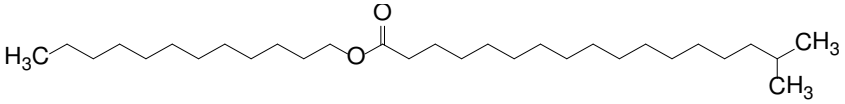
126. Octyldodecyl Isostearate (one example of an "iso")



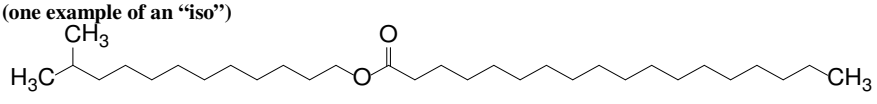
127. Isostearyl Laurate (one example of an "iso")



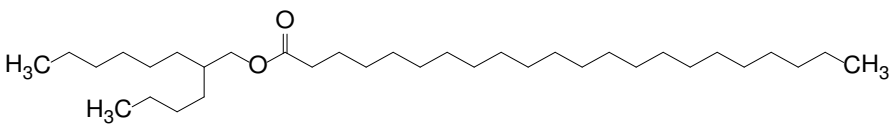
128. Lauryl Isostearate (one example of an "iso")



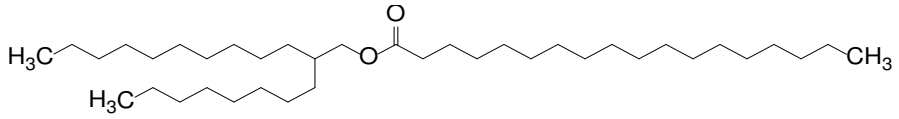
129. Isotridecyl Stearate (one example of an "iso")



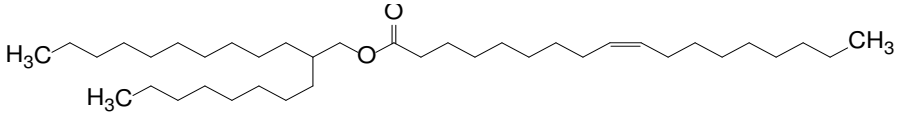
130. Butyloctyl Behenate



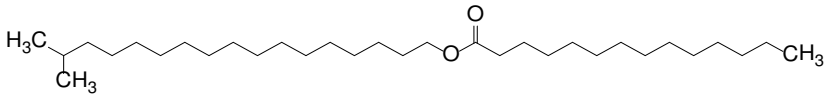
131. Octyldodecyl Stearate



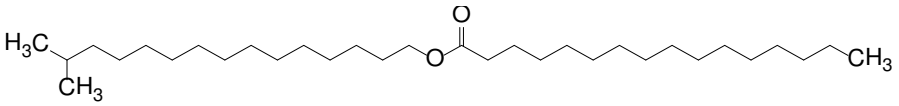
132. Octyldodecyl Oleate



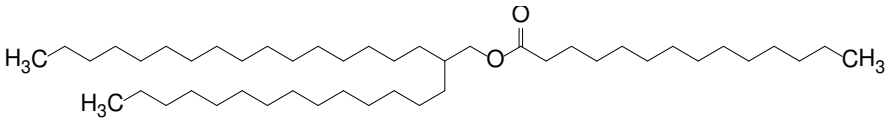
133. Isostearyl Myristate (one example of an "iso")



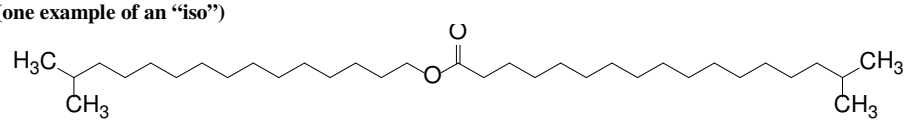
134. Isocetyl Palmitate (one example of an "iso")



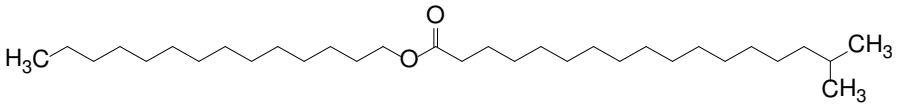
135. Tetradecyloctadecyl Myristate



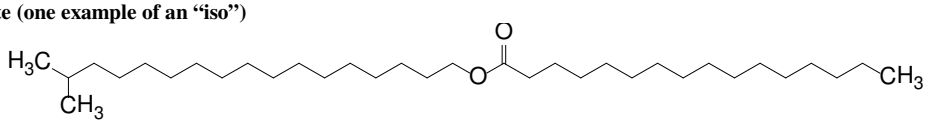
136. Isocetyl Isostearate (one example of an "iso")



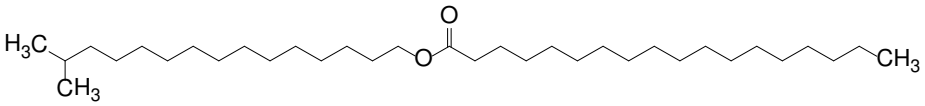
137. Myristyl Isostearate (one example of an "iso")



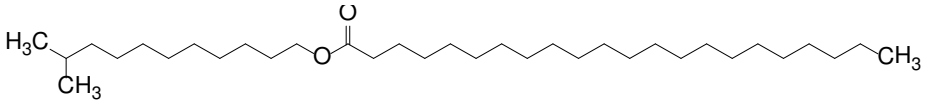
138. Isostearyl Palmitate (one example of an "iso")



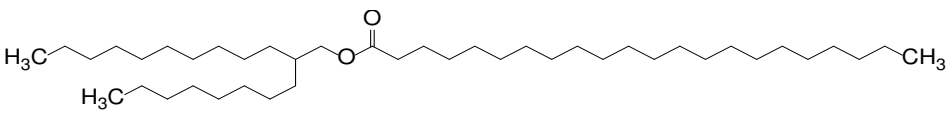
139. Isocetyl Stearate (one example of an "iso")



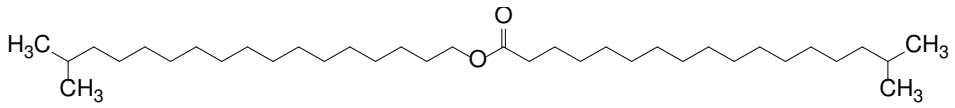
140. Isolauryl Behenate (one example of an "iso")



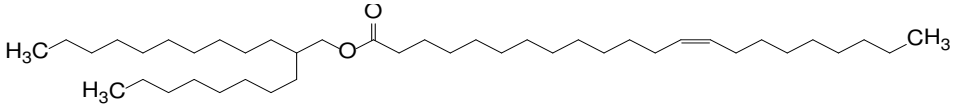
141. Octyldodecyl Behenate



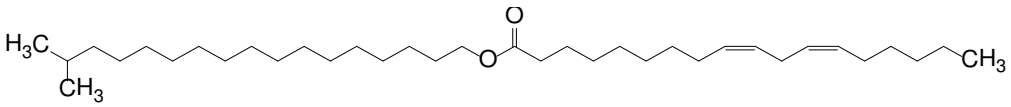
142. Isostearyl Isostearate (one example of an "iso")



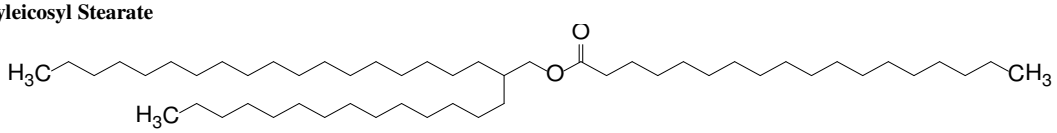
143. Octyldodecyl Erucate



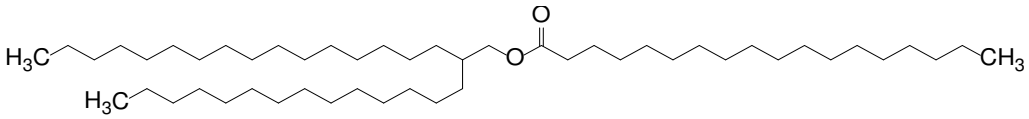
144. Isostearyl Linoleate (one example of an "iso")



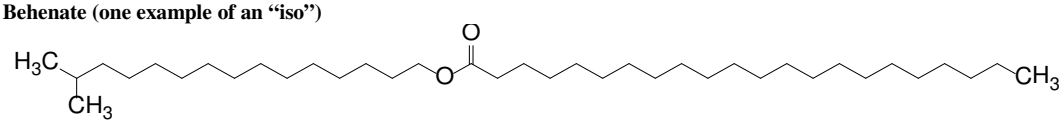
145. Tetradecyleicosyl Stearate



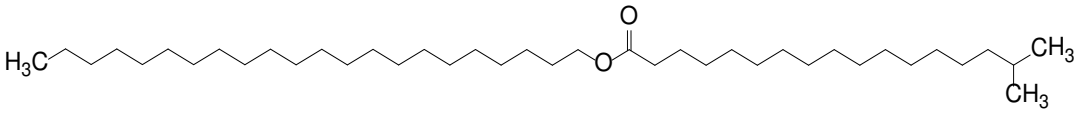
146. Tetradecyloctadecyl Stearate



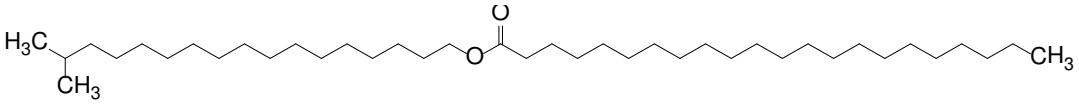
147. Isocetyl Behenate (one example of an "iso")



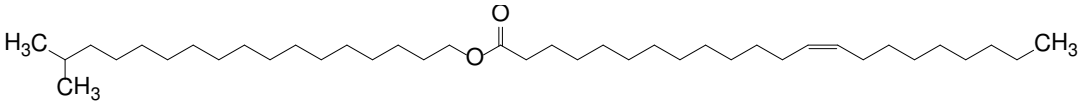
148. Behenyl Isostearate (one example of an "iso")



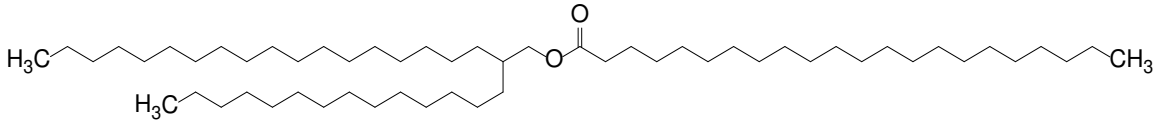
149. Isostearyl Behenate (one example of an "iso")



150. Isostearyl Erucate (one example of an "iso")

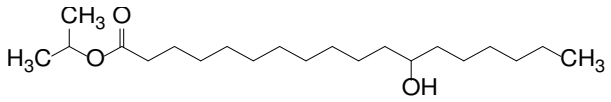


151. Tetradecyloctadecyl Behenate

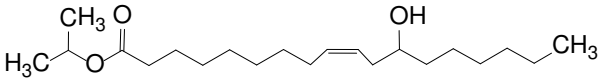


Hydroxy-substituted, by longest length

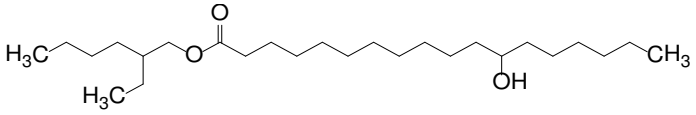
152. Isopropyl Hydroxystearate



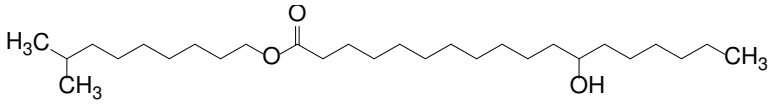
153. Isopropyl Ricinoleate



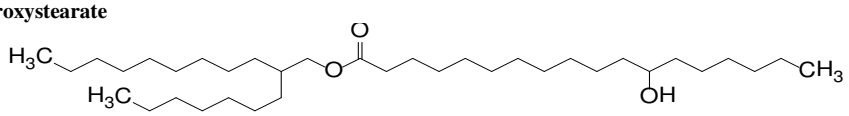
154. Ethylhexyl Hydroxystearate



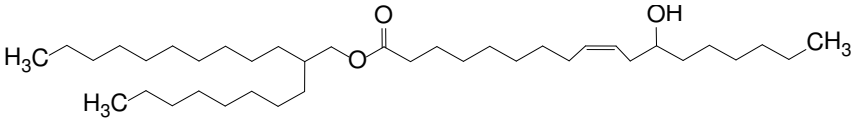
155. Isodecyl Hydroxystearate (one example of an "iso")



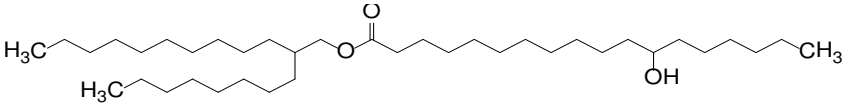
156. Heptylundecyl Hydroxystearate



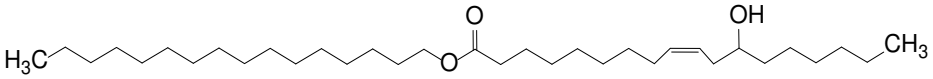
157. Octyldodecyl Ricinoleate



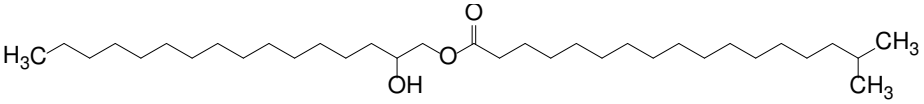
158. Octyldodecyl Hydroxystearate



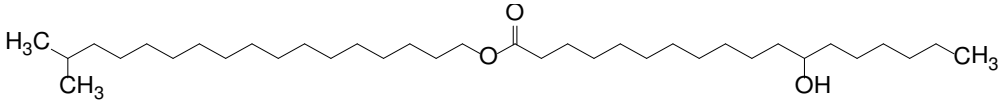
159. Cetyl Ricinoleate



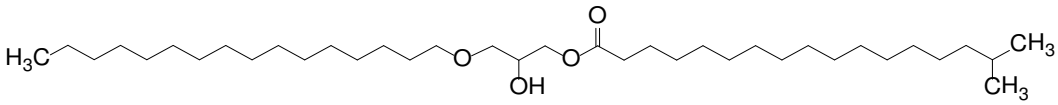
160. Hydroxycetyl Isostearate (one example of an "iso")



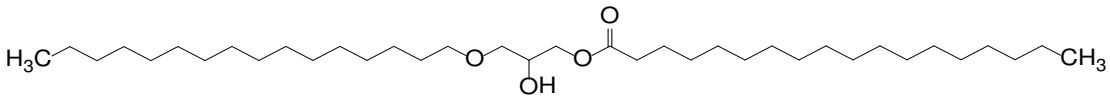
161. Isostearyl Hydroxystearate (one example of an "iso")



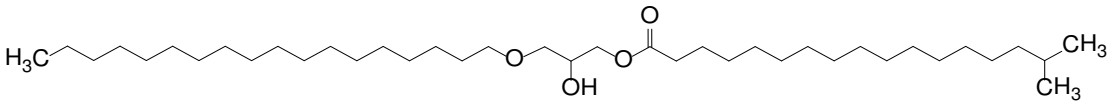
162. Chimyl Isostearate (one example of an "iso")



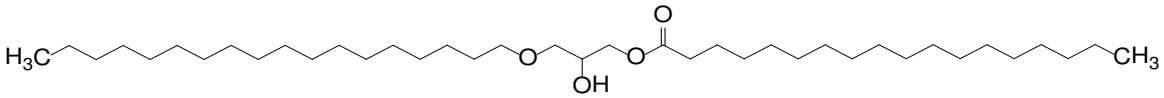
163. Chimyl Stearate



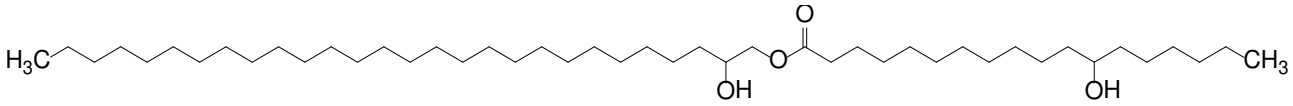
164. Batyl Isostearate (one example of an "iso")



165. Batyl Stearate

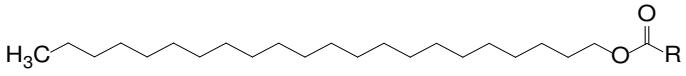


166. Hydroxyoctacosanyl Hydroxystearate



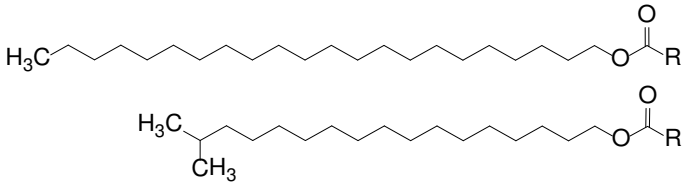
Mixtures (alphabetical)

167. Behenyl Beeswax



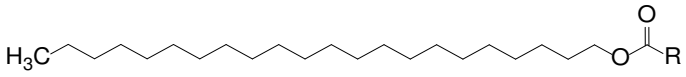
wherein R is an alkyl chain 23 to 35 carbons long

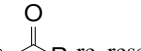
168. Behenyl/Isostearyl Beeswax (one example of an "iso")



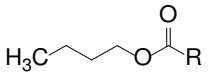
wherein R is an alkyl chain 23 to 35 carbons long

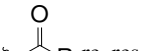
169. Behenyl Olivate



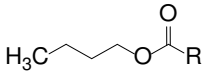
wherein  represents the fatty acids derived from olive oil

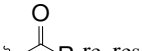
170. Butyl Avocadate



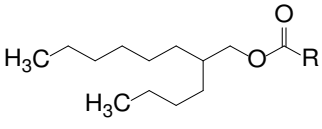
wherein  represents the fatty acids derived from avocado oil

171. Butyl Babassuate



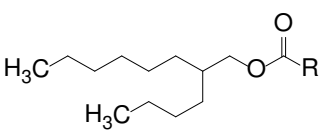
wherein  represents the fatty acids derived from babassu oil

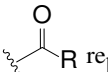
172. Butyloctyl Beeswax



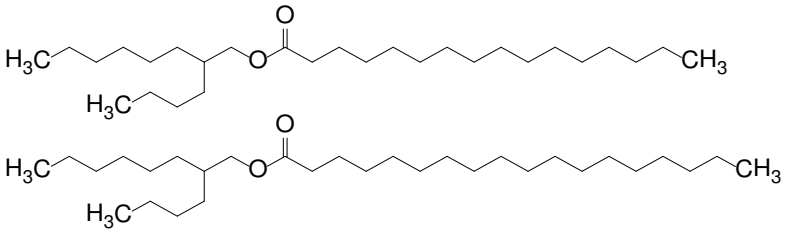
wherein R is an alkyl chain 23 to 35 carbons long

173. Butyloctyl Candelillate

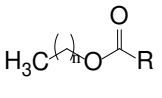


wherein  represents the fatty acids derived from candelilla oil

174. Butyloctyl Cetearate

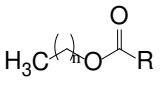


175. C14-30 Alkyl Beeswax



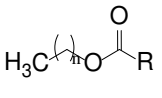
wherein R is an alkyl chain 23 to 35 carbons long and n is 13 to 29

176. C18-38 Alkyl Beeswax



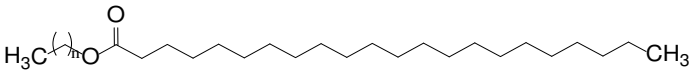
wherein R is an alkyl chain 23 to 35 carbons long and n is 17 to 37

177. C30-50 Alkyl Beeswax



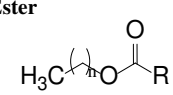
wherein R is an alkyl chain 23 to 35 carbons long and n is 29 to 49

178. C20-40 Alkyl Behenate



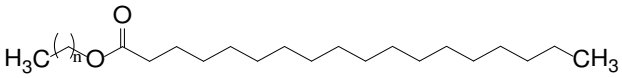
wherein n is 19 to 39

179. C18-38 Alkyl C24-54 Acid Ester



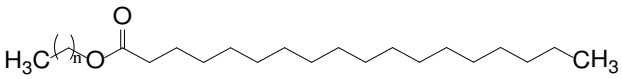
wherein R is an alkyl chain 23 to 53 carbons long and n is 17 to 37

180. C16-36 Alkyl Stearate



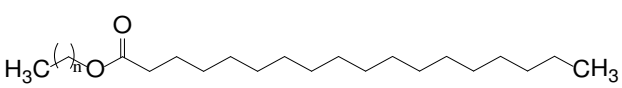
wherein n is 15 to 35

181. C20-40 Alkyl Stearate



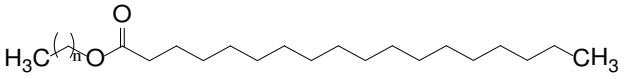
wherein n is 19 to 39

182. C30-50 Alkyl Stearate

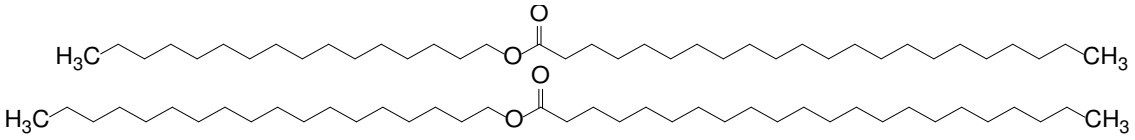


wherein n is 29 to 49

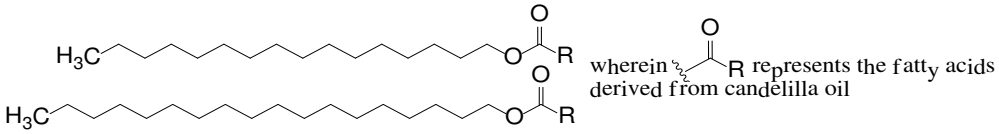
183. C40-60 Alkyl Stearate



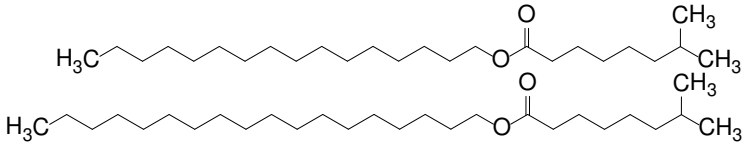
184. Cetearyl Behenate



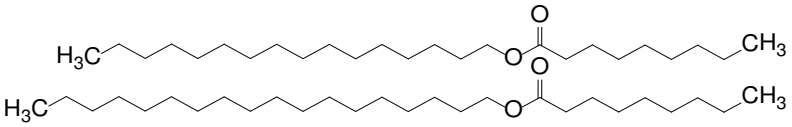
185. Cetearyl Candelillate



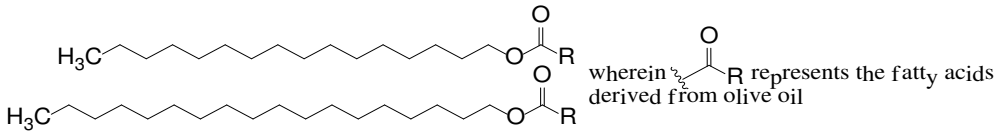
186. Cetearyl Isononanoate (one example of an "iso")



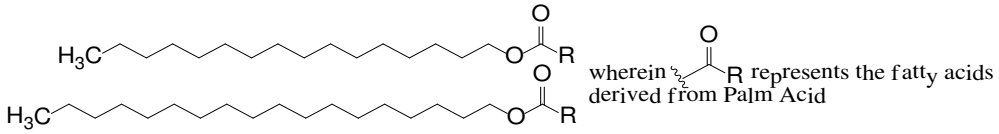
187. Cetearyl Nonanoate



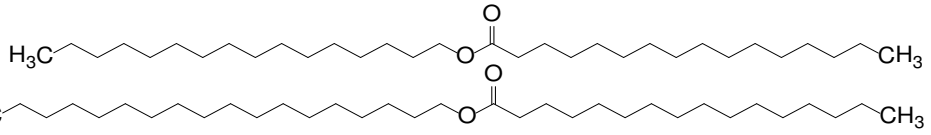
188. Cetearyl Olivate



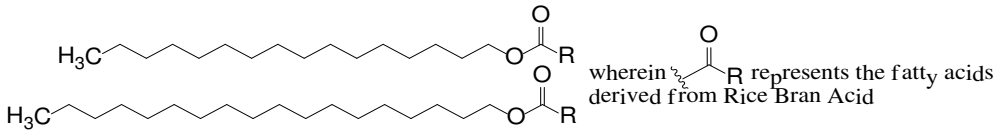
189. Cetearyl Palmate



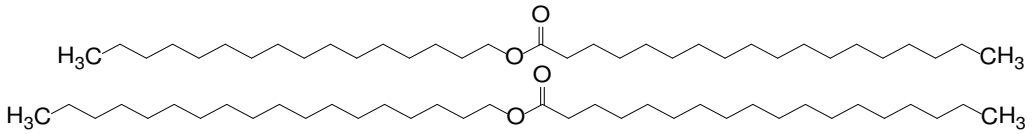
190. Cetearyl Palmitate



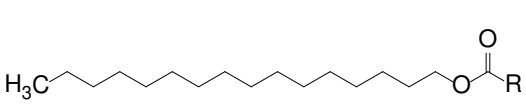
191. Cetearyl Rice Branate



192. Cetearyl Stearate

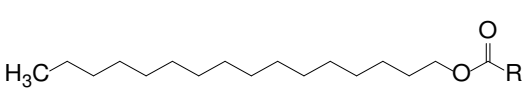


193. Cetyl Babassuate



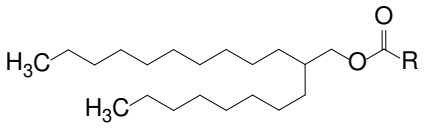
wherein  represents the fatty acids derived from babassu oil

194. Cetyl Tallowate



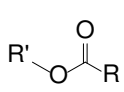
wherein  represents the fatty acids derived from Tallow Acid

195. C10-40 Isoalkyl Acid Octyldodecanol Esters



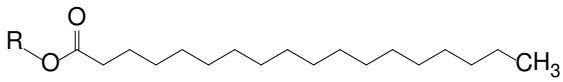
wherein R is a branched alkyl chain 9 to 39 carbons long

196. C4-5 Isoalkyl Cocoate



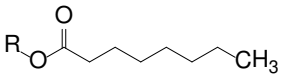
wherein  represents the fatty acids derived from Coconut Acid and R' is a branched alkyl chain, 4 to 5 carbons long

197. C32-36 Isoalkyl Stearate



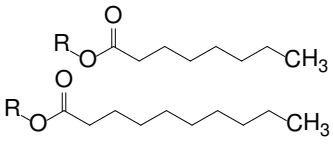
wherein R is a branched alkyl chain, 32 to 36 carbons long

198. Coco-Caprylate



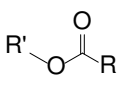
wherein R represents the fatty alcohols residues from coconut

199. Coco-Caprylate/Caprate



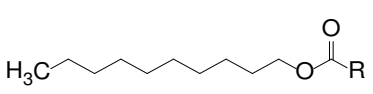
wherein R represents the fatty alcohols residues from coconut

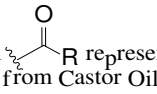
200. Coco-Rapeseedate



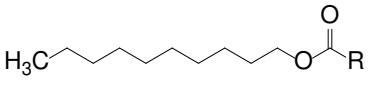
wherein  represents the fatty acids derived from Rapeseed Oil and R' represents the fatty alcohol residues from coconut

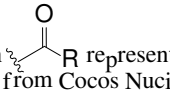
201. Decyl Castorate



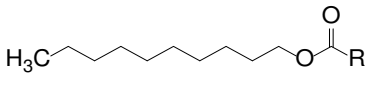
wherein  represents the fatty acids derived from Castor Oil

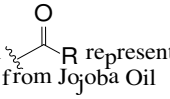
202. Decyl Cocoate



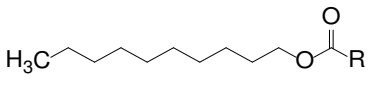
wherein  represents the fatty acids derived from Cocos Nucifera (Coconut) Oil

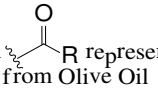
203. Decyl Jojobate



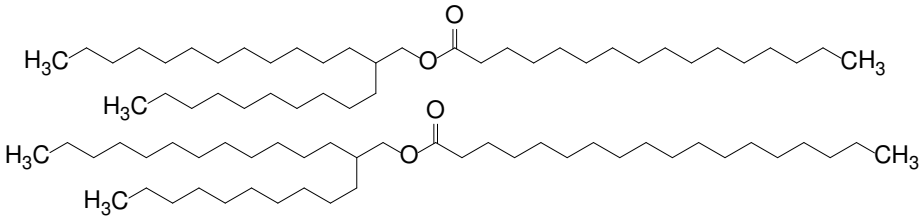
wherein  represents the fatty acids derived from Jojoba Oil

204. Decyl Olivate

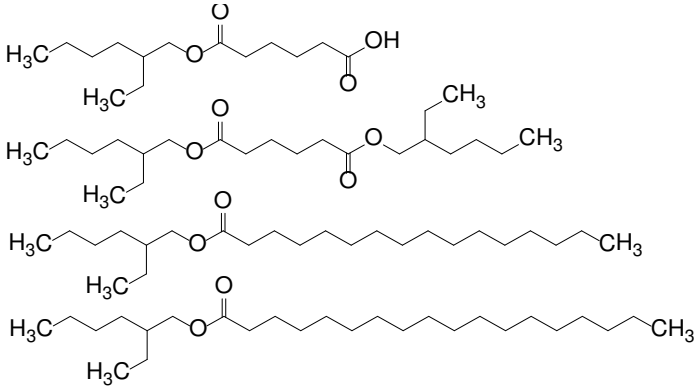


wherein  represents the fatty acids derived from Olive Oil

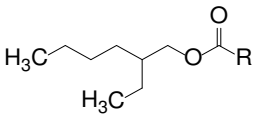
205. Decyltetradecyl Cetearate



206. Ethylhexyl Adipate/Palmitate/Stearate

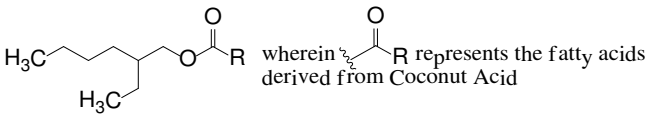


207. Ethylhexyl C10-40 Isoalkyl Acidate

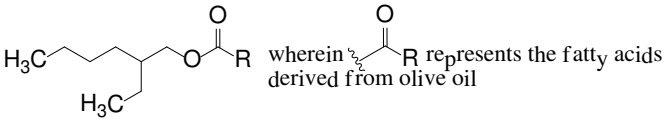


wherein R is a branched alkyl chain, 9 to 39 carbons long

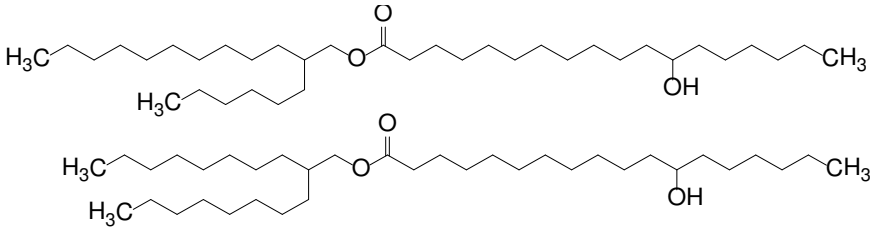
208. Ethylhexyl Cocoate



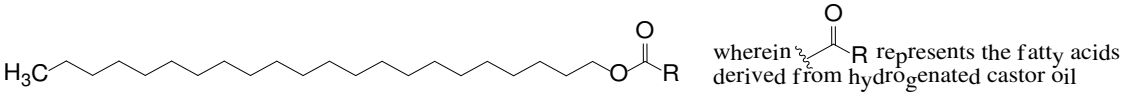
209. Ethylhexyl Olivate



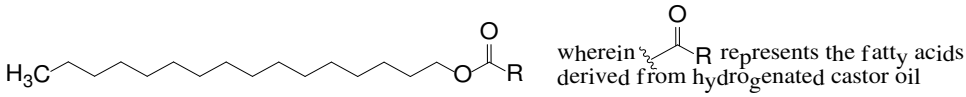
210. Hexyldodecyl/Octyldecyl Hydroxystearate



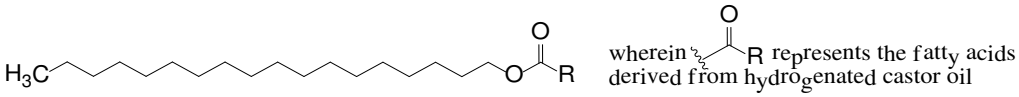
211. Hydrogenated Castor Oil Behenyl Esters



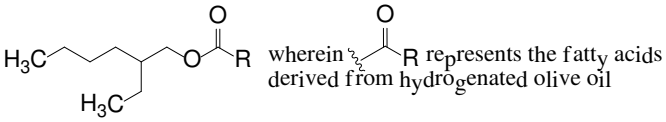
212. Hydrogenated Castor Oil Cetyl Esters



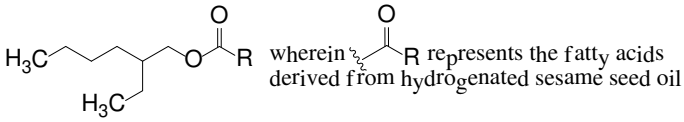
213. Hydrogenated Castor Oil Stearyl Esters



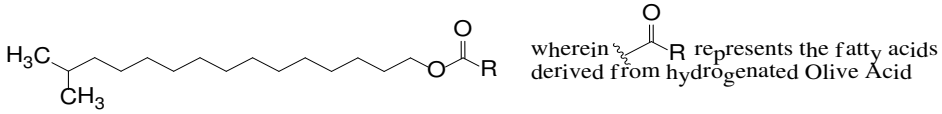
214. Hydrogenated Ethylhexyl Olivate



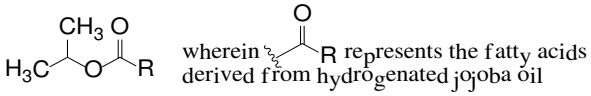
215. Hydrogenated Ethylhexyl Sesamate



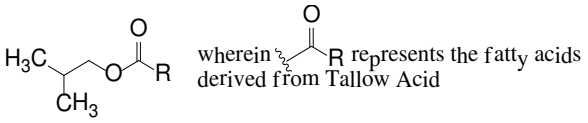
216. Hydrogenated Isocetyl Olivate (one example of an "iso")



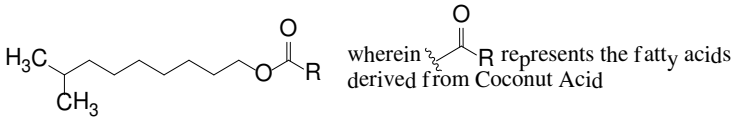
217. Hydrogenated Isopropyl Jojobate



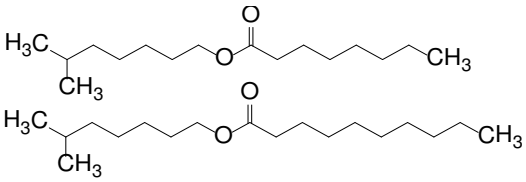
218. Isobutyl Tallowate



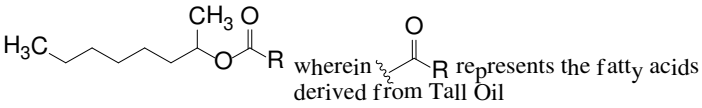
219. Isodecyl Cocoate (one example of an "iso")



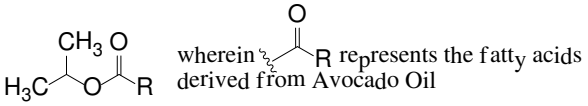
220. Isooctyl Caprylate/Caprate (one example of an "iso")



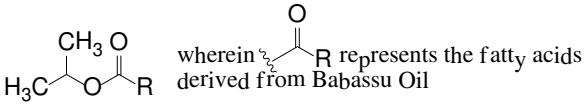
221. Isooctyl Tallate (one example of an "iso")



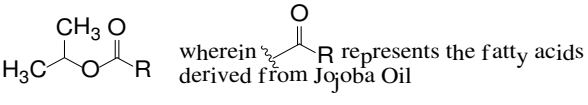
222. Isopropyl Avocadate



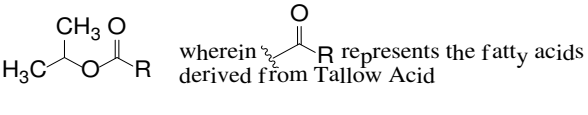
223. Isopropyl Babassuate



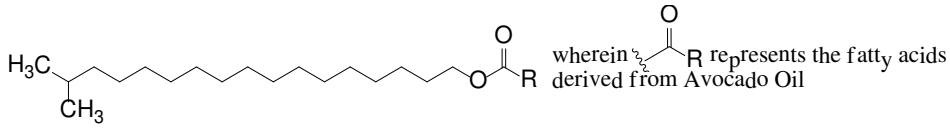
224. Isopropyl Jojobate



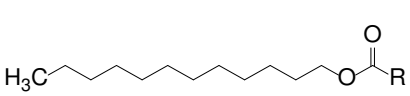
225. Isopropyl Tallowate

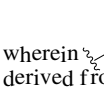


226. Isostearyl Avocadate (one example of an "iso")



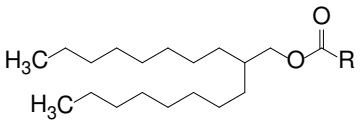
227. Lauryl Cocoate

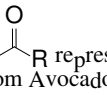




wherein R represents the fatty acids derived from coconut oil

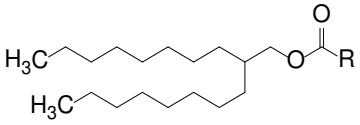
228. Octyldodecyl Avocadoate





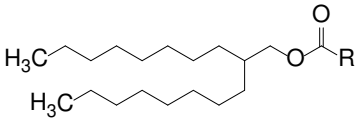
wherein R represents the fatty acids derived from Avocado Oil

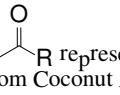
229. Octyldodecyl Beeswax



wherein R is an alkyl chain 23 to 35 carbons long

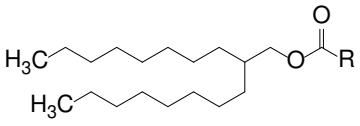
230. Octyldodecyl Cocoate

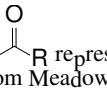




wherein R represents the fatty acids derived from Coconut Acid

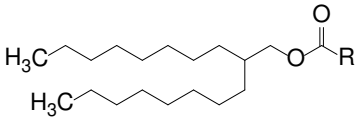
231. Octyldodecyl Meadowfoamate

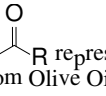




wherein R represents the fatty acids derived from Meadowfoam Seed Oil

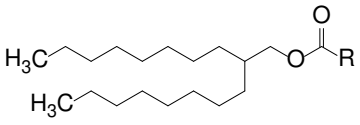
232. Octyldodecyl Olivate

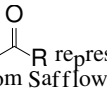




wherein R represents the fatty acids derived from Olive Oil

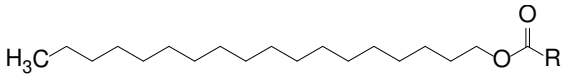
233. Octyldodecyl Safflowerate





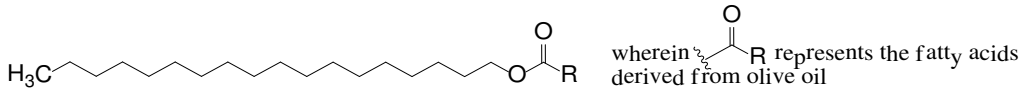
wherein R represents the fatty acids derived from Safflower Seed Oil

234. Stearyl Beeswax



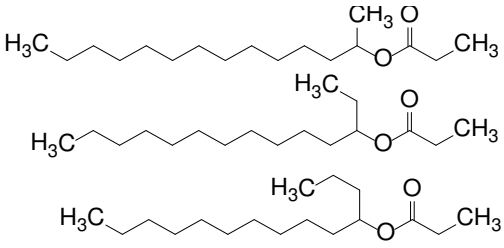
wherein R is an alkyl chain 23 to 35 carbons long

235. Stearyl Olivate

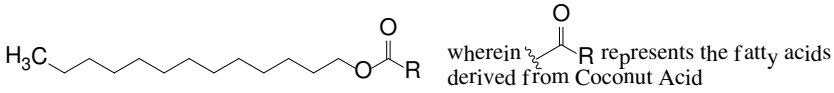


236. Tetradecylpropionates

Chiefly:



237. Tridecyl Cocoate



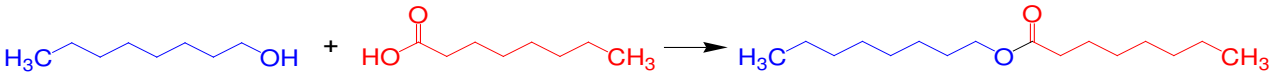


Figure 2. Synthesis of capryl caprylate from capryl alcohol and caprylic acid

TABLES

Table 1. Alkyl Esters Group (presented alphabetically)

Arachidyl Behenate
Arachidyl Erucate
Arachidyl Propionate#
Batyl Isostearate
Batyl Stearate
Behenyl Beeswax
Behenyl Behenate
Behenyl Erucate
Behenyl Isostearate
Behenyl Olivate
Behenyl/Isostearyl Beeswax
Butyl Avocadate
Butyl Babassuate
Butyl Isostearate
Butyl Myristate#
Butyl Oleate
Butyl Stearate#
Butyloctyl Beeswax
Butyloctyl Behenate
Butyloctyl Candelillate
Butyloctyl Cetearate
Butyloctyl Oleate
Butyloctyl Palmitate
C10-40 Isoalkyl Acid Octyldodecanol Esters
C14-30 Alkyl Beeswax
C16-36 Alkyl Stearate
C18-38 Alkyl Beeswax
C18-38 Alkyl C24-54 Acid Ester
C20-40 Alkyl Behenate
C20-40 Alkyl Stearate
C30-50 Alkyl Beeswax
C30-50 Alkyl Stearate
C32-36 Isoalkyl Stearate
C40-60 Alkyl Stearate
C4-5 Isoalkyl Cocoate
Caprylyl Butyrate
Caprylyl Caprylate
Caprylyl Eicosenoate
Cetearyl Behenate
Cetearyl Candelillate
Cetearyl Isononanoate#
Cetearyl Nonanoate#
Cetearyl Olivate
Cetearyl Palmate
Cetearyl Palmitate
Cetearyl Rice Branate
Cetearyl Stearate
Cetyl Babassuate
Cetyl Behenate
Cetyl Caprate
Cetyl Caprylate
Cetyl Dimethyloctanoate
Cetyl Esters
Cetyl Isononanoate#
Cetyl Laurate
Cetyl Myristate#
Cetyl Myristoleate
Cetyl Oleate
Cetyl Palmitate#
Cetyl Ricinoleate#
Cetyl Stearate#
Cetyl Tallowate
Chimyl Isostearate
Chimyl Stearate
Coco-Caprylate
Coco-Caprylate/Caprate
Coco-Rapeseedate
Decyl Castorate
Decyl Cocoate#
Decyl Isostearate
Decyl Jojobate
Decyl Laurate
Decyl Myristate#
Decyl Oleate#
Decyl Palmitate
Decyltetradecyl Cetearate
Erucyl Arachidate
Erucyl Erucate
Erucyl Oleate
Ethylhexyl Adipate/Palmitate/Stearate
Ethylhexyl C10-40 Isoalkyl Acidate
Ethylhexyl Cocoate#
Ethylhexyl Hydroxystearate
Ethylhexyl Isononanoate#
Ethylhexyl Isopalmitate
Ethylhexyl Isostearate
Ethylhexyl Laurate
Ethylhexyl Myristate#
Ethylhexyl Neopentanoate
Ethylhexyl Oleate
Ethylhexyl Olivate
Ethylhexyl Palmitate#
Ethylhexyl Pelargonate#
Ethylhexyl Stearate#
Heptyl Undecylenate
Heptylundecyl Hydroxystearate
Hexyl Isostearate
Hexyl Laurate
Hexyldecyl Hexyldecanoate
Hexyldecyl Isostearate
Hexyldecyl Laurate
Hexyldecyl Oleate
Hexyldecyl Palmitate
Hexyldecyl Stearate
Hexyldodecyl/Octyldecyl Hydroxystearate
Hydrogenated Castor Oil Behenyl Esters
Hydrogenated Castor Oil Cetyl Esters
Hydrogenated Castor Oil Stearyl Esters
Hydrogenated Ethylhexyl Olivate
Hydrogenated Ethylhexyl Sesamate
Hydrogenated Isocetyl Olivate
Hydrogenated Isopropyl Jojobate
Hydroxycetyl Isostearate
Hydroxyoctacosanyl Hydroxystearate
Isoamyl Laurate
Isobutyl Myristate#
Isobutyl Palmitate
Isobutyl Perlargonate#
Isobutyl Stearate#
Isobutyl Tallowate
Isocetyl Behenate
Isocetyl Isodecanoate
Isocetyl Isostearate
Isocetyl Laurate
Isocetyl Myristate
Isocetyl Palmitate
Isocetyl Stearate#
Isodecyl Cocoate#
Isodecyl Hydroxystearate
Isodecyl Isononanoate#
Isodecyl Laurate
Isodecyl Myristate#
Isodecyl Neopentanoate
Isodecyl Oleate#
Isodecyl Palmitate
Isodecyl Stearate
Isohexyl Caprate
Isohexyl Laurate
Isohexyl Neopentanoate
Isohexyl Palmitate
Isolauryl Behenate
Isononyl Isononanoate#
Isooctyl Caprylate/Caprate
Isooctyl Tallate
Isopropyl Arachidate
Isopropyl Avocadate
Isopropyl Babassuate
Isopropyl Behenate
Isopropyl Hydroxystearate
Isopropyl Isostearate#
Isopropyl Jojobate
Isopropyl Laurate
Isopropyl Linoleate
Isopropyl Myristate#
Isopropyl Oleate
Isopropyl Palmitate#
Isopropyl Ricinoleate#
Isopropyl Stearate#
Isopropyl Tallowate
Isostearyl Avocadate
Isostearyl Behenate
Isostearyl Erucate
Isostearyl Hydroxystearate
Isostearyl Isononanoate#
Isostearyl Isostearate
Isostearyl Laurate
Isostearyl Linoleate
Isostearyl Myristate#
Isostearyl Neopentanoate#
Isostearyl Palmitate
Isotridecyl Isononanoate#
Isotridecyl Laurate
Isotridecyl Myristate#
Isotridecyl Stearate
Lauryl Behenate
Lauryl Cocoate#
Lauryl Isostearate
Lauryl Laurate
Lauryl Myristate#
Lauryl Oleate
Lauryl Palmitate
Lauryl Stearate
Lignoceryl Erucate
Myristyl Isostearate
Myristyl Laurate
Myristyl Myristate#
Myristyl Neopentanoate
Myristyl Stearate#
Octyldecyl Oleate
Octyldodecyl Avocadoate
Octyldodecyl Beeswax
Octyldodecyl Behenate
Octyldodecyl Cocoate#
Octyldodecyl Erucate
Octyldodecyl Hydroxystearate
Octyldodecyl Isostearate
Octyldodecyl Meadowfoamate
Octyldodecyl Myristate#
Octyldodecyl Neodecanoate
Octyldodecyl Neopentanoate
Octyldodecyl Octyldodecanoate
Octyldodecyl Oleate
Octyldodecyl Olivate
Octyldodecyl Ricinoleate#
Octyldodecyl Safflowerate
Octyldodecyl Stearate
Oleyl Arachidate
Oleyl Erucate
Oleyl Linoleate
Oleyl Myristate#
Oleyl Oleate
Oleyl Stearate
Propylheptyl Caprylate
Tetradecyloctadecyl Stearate
Tetradecylpropionates
Tridecyl Cocoate#
Tridecyl Behenate
Tridecyl Erucate
Tridecyl Isononanoate#
Tridecyl Laurate
Tridecyl Myristate#
Tridecyl Neopentanoate

Table 1. Alkyl Esters Group (presented alphabetically)

Stearyl Beeswax	Stearyl Linoleate	Tetradecyloctadecyl Behenate
Stearyl Caprylate[#]	Stearyl Olivate[#]	Tetradecyloctadecyl Hexyldecanoate
Stearyl Behenate[#]	Stearyl Palmitate[#]	Tetradecyloctadecyl Myristate[#]
Stearyl Erucate	Stearyl Stearate[#]	Tridecyl Stearate
Stearyl Heptanoate[#]	Tetradecyleicosyl Stearate	

[#]indicates the ingredient was reviewed previously by the CIR

Table 2. Conclusions (year issued) and data summaries of previously reviewed alkyl esters

Alkyl Ester	Conclusion (Year)	Summary data	Reference
Final report on the safety assessment of arachidyl propionate.			
Arachidyl Propionate	safe as used (1990; reaffirmed 2008)	- the acute oral LD_{50} in rats was >20 g/kg; up to 2500 mg/kg at concentrations of 25% in corn oil was not toxic in a 90-day oral study - the acute dermal LD_{50} in rabbits was > 2 g/kg - not a primary irritant to rabbit skin when tested undiluted, a formulation containing 7% was not irritating in a 24 h SIOPT, and a 10% solution was non-irritating and undiluted test article was slightly irritating in a cumulative irritation test; not a sensitizer when injected undiluted test material, and was not comedogenic when tested undiluted - undiluted test material and a formulation containing 7% were not irritating to rabbit eyes	7,13
Final report on the amended safety assessment of myristic acid and its salts and esters as used in cosmetics. (2010) ***Final report on the safety assessment of butyl myristate. (1990)***			
		- Discussion item: data on myristic acid myristyl and isopropyl myristate were extrapolated and also used in the determination of safety (1990 report)	16
Butyl Myristate	safe as used (1990; 2010)	- was observed to enhance dermal penetration of some chemicals - the oral LD_{50} in rats was >8 g/kg - a single application of 2 g/kg was non-toxic and non-irritating in rabbits - a 24 h occlusive application of undiluted test material produced moderate irritation (PII = 2.88) in rabbits; a moderate irritant but not a sensitizer in guinea pigs when injected intradermally - non-irritating to rabbit eyes	14,16
Cetyl Myristate	safe as used (2010)	- no data were available	16
Decyl Myristate	safe as used (2010)	- no data were available	16
Ethylhexyl Myristate	safe as used (2010)	- no data were available	16
Isobutyl Myristate	safe as used (2010)	- no data were available	16
Isocetyl Myristate	safe as used (2010)	- no data were available	16
Isodecyl Myristate	safe as used (2010)	no data were available	16
Isopropyl Myristate	safe as used (1982; 2010)	- in a study in which monkeys were exposed for 5 sec to an aerosol antiperspirant containing an unspecified concentration of [^{14}C]isopropyl myristate, the distribution in the exhaled air and in several tissues indicated only 0.25% of the sprayed dose was absorbed and about 10% of this reached the lower respiratory tract - the acute oral LD_{50} was >16 ml/kg in rats and 49.7 ml/kg in mice - the acute dermal LD_{50} in rabbits was 5 g/kg; dermal application of 2 g/kg a formulation containing 16-20% in rabbits for 26 days (20 applications) did not produce signs of toxicity but did cause severe erythema and moderate edema and other dermal effects and microscopically marked to severe acanthosis and hyperkeratosis and mixed inflammatory cell infiltration; application of 2 ml/kg of a formulation containing 43-47% in rabbits for 4 wks (21 applications) produced erythema, edema, drying, cracking, and fissuring, but microscopic effects were only seen at the application site - 1 h inhalation exposure to formulations containing 16-20% (33-41 mg/l) and 4.7% (9.7 mg/l) did not produce any deaths or evidence of systemic toxicity in rats; in 13-wk inhalation studies, a formulation containing 16-20% was not toxic to guinea pigs (daily mean concentration of 63.3-224 mg/m^3 air for three 1-h exposures/day) but did produce coughing and wheezing in monkeys. Macrophage accumulations within the alveolar and bronchiolar walls were seen in the lungs in direct proportion to the dosage of the aerosol (5.3-37.0 mg/m^3 in air) - a 50% solution in isopropyl alcohol significantly accelerated the carcinogenic activity of 0.15% benzo[a]pyrene on the skin of mice; no tumors were produced in mice by application of a 1% solution for 18 wks; applications of 10-100% to the backs of Swiss mice 2x/wk did not result in test article-related carcinogenic lesions - in Draize tests, undiluted test material and 15-58% in formulations was at mostly minimally irritating to the skin of rabbits, however, application of undiluted test material for 3 days was moderately to severely irritating; produced comedogenic activity in rabbit ears - in human testing, undiluted test material was not irritating (15 subjects) and the highest PII with formulations containing 15-58% was 0.1 (9-50%) in primary irritation studies; in cumulative irritation studies, undiluted test material (25 subjects) and formulations containing 15-58% (9-13 subjects) were minimally irritating; no sensitization was seen in maximization studies (20% in pet. or -42.9% in formulation; 25 subjects) or RIPTs (15 and 52-58%; 99 and 320 subjects); a formulation containing 42.9% was not phototoxic (10 subjects) or a photoallergen (25 subjects) - undiluted material was minimally irritating to rabbit eyes and formulations containing 15-58% were non- to mildly irritating - not genotoxic in the *Salmonella*/microsome test	10,16
Isostearyl Myristate	safe as used (2010)	- mixed results were seen regarding dermal penetration enhancement - in a study in which monkeys were exposed for 5 sec to an aerosol antiperspirant containing test	16

Table 2. Conclusions (year issued) and data summaries of previously reviewed alkyl esters

Alkyl Ester	Conclusion (Year)	Summary data	Reference
		material, the distribution in the exhaled air and in several tissues indicated only 0.25% of the sprayed dose was absorbed and about 10% of this reached the lower respiratory tract - no other data were available	
Isotridecyl Myristate	safe as used (2010)	- no data were available	16
Lauryl Myristate	safe as used (2010)	- no data were available	16
Myristyl Myristate	safe as used (1982; 2010)	- the acute oral LD_{50} in rats was >14.4 g/kg - the acute dermal LD_{50} in rabbits was >2 g/kg - undiluted test material was at most mildly irritating in rabbits; produced comedogenic activity in rabbit ears - in human studies, 8% in formulation was not an irritant (20 subjects) or sensitizer (196 subjects) - undiluted material, 15-50% in corn oil, and formulations containing 15-58% were non- to minimally irritating in rabbit eyes	10,16
Octyldodecyl Myristate	safe as used (2010)	- no data were available	16
Oleyl Myristate	safe as used (2010)	- no data were available	16
Tetradecyloctadecyl Myristate	safe as used (2010)	- no data were available	16
Tridecyl Myristate	safe as used (2010)	- no data were available	16
Final report on the safety assessment of butyl stearate, cetyl stearate, isobutyl stearate, isocetyl stearate, isopropyl stearate, myristyl stearate, and octyl stearate.			
Butyl Stearate	safe as used (1985, reaffirmed 2005)	- the acute oral LD_{50} in rats was >32 g/kg; in a 2 yr feeding study in rats with up to 6000 mg/kg/day, no test article-related toxicity was observed - dietary administration of 6.25% to male and female rats for 10 wks prior to mating did not affect fertility, litter size, or neonate survival, but growth was decreased pre- and post-weaning - undiluted test material was at most moderately irritating (in one study) to rabbit skin (PIIs ranged from 0-2.75); 0.1% in physiological saline was not a sensitizer in 2 guinea pigs when tested using intracutaneous injections; 50% in mineral oil weakly comedogenic in rabbits in a 2 wk study - in human testing, 24 and 48 h occlusive patch testing with 2% in formulation resulted in PIIs of 0.03 and 0.11, respectively (number of subjects not specified); 50% in mineral oil was at most a mild irritant and was not a sensitizer in an RIPT (111 subjects); 10% in formulation was not an irritant, sensitizer, (54 subjects) or photosensitizer (10 subjects) - undiluted test material was not irritating to rabbit eyes	5,11
Cetyl Stearate	safe as used (1985, reaffirmed 2005)	- 50% in mineral oil was at most a mild irritant and was not a sensitizer in an RIPT (111 subjects), although sensitization was reported in 1 subject	5,11
Ethylhexyl Stearate (originally Octyl Stearate)	safe as used (1985, reaffirmed 2005)	- the acute oral LD_{50} in rats was >8 ml/kg - undiluted test material was at most mildly irritating to rabbit skin (PIIs 0.0 and 1.42); in a 6-day cumulative skin irritation study, undiluted test material had a MMII of 0.67 and was poorly tolerated and a 10% aq. solution had a MMII of 0.33 was relatively well tolerated - in human testing, a formulation containing 7.6% was not an irritant or sensitizer (56 subjects), not phototoxic (10 subjects), and not a photosensitizer (27 subjects), although some slight reactions were reported in the photosensitization study - undiluted test material did not provoke any significant injury in rabbit eyes (max PII 4.67/100 at 1 h) Discussion item: the Panel noted that the reproductive toxicity of 2-ethyl-1-hexanol was addressed in a fetotoxicity study (performed on diethylhexyl adipate); it was suggested that the fetotoxicity reported for mice in that study was actually due to a zinc deficiency and that given the extent of 2-ethyl-1-hexanol absorption and the load that would be expected to enter the hepatic circulation, the potential for 2-ethyl-1-hexanol-induced reproductive toxicity was not thought to be an issue	5,11
Isobutyl Stearate	safe as used (1985, reaffirmed 2005)	- undiluted test material was mildly irritating to rabbit skin (PIIs =0.62) in a 24 h occlusive study - in human testing, a mild irritant and not a sensitizer when tested undiluted in an RIPT (149 subjects); 50% in mineral oil was not phototoxic or a photosensitizer (23 subjects)	5,11
Isocetyl Stearate	safe as used (1985, reaffirmed 2005)	- no data were available	5,11
Isopropyl Stearate	safe as used (1985, reaffirmed 2005)	- maximum reported use concentration was up to 25% in a leave-on formulation - the acute oral LD_{50} in rats was >8 ml/kg - undiluted test material was moderately irritating to rabbit skin (PIIs 2.35 in two studies) - in human testing, 1.0% in formulation was non- (105 subjects) to slightly irritating (12 subjects) and produced no adverse reactions in a 4-wk use test (40 subjects) - undiluted test material was not irritating to rabbit eyes	5,11
Myristyl Stearate	safe as used (1985, reaffirmed 2005)	- maximum reported use concentration was up to 5% in a leave-on formulation - the acute oral LD_{50} in mice was >10 g/kg with corn oil and >1 g/kg neat - undiluted test material was not irritating to rabbit skin (PII = 0.0) - in human testing, formulations containing 2.35 – 9.8% produced no skin reactions in open and closed patch tests 22-100 subjects/test) - undiluted test material produced slight vessel injection involving only the conjunctivae at 24 h and no irritation was observed on days 2-7	5,11

Table 2. Conclusions (year issued) and data summaries of previously reviewed alkyl esters

Alkyl Ester	Conclusion (Year)	Summary data	Reference
Final report on the safety assessment of pelargonic acid (aka nonanoic acid) and the nonanoate esters)			
		Discussion items: because of the skin penetration enhancement property of pelargonic acid in the presence of p-aminobenzoic acid, care should be taken in formulating products containing this ingredient in combination with any ingredients whose safety was based on lack of dermal absorption or when dermal absorption was a concern; because animal sources have been reported, this ingredient must be free of detectable pathogenic viruses or infectious agents	19
Cetearyl Isononanoate	safe as used (2010)	- the oral LD_{50} in mice was >5 g/kg; in an oral study in which rats were dosed with 100, 300, or 1000 mg/kg, reversible fatty alterations were induced in the liver of female mid dose and male and female high dose animals and the NOAEL was 100 mg/kg/day - not a reproductive toxicant in a study in which 100-1000 mg/kg was administered orally to gravid rats on days 6-15 of gestation, and the NOAEL for maternal and embryo-/fetotoxicity was 100 mg/kg - not mutagenic in an Ames test at doses up to 5000 µg/plate with or without metabolic activation - slightly irritating to the skin of hairless mice and not irritating to rabbit skin; not a sensitizer in guinea pigs (25% injected intracutaneously at induction and challenge); 10-100% was not comedogenic in rabbit ears - in human testing, 20% active and undiluted test material had very good skin compatibility in a 24-h SIOPT (21 subjects); a formulation containing 1.5% was not a contact allergen in a maximization test (25 subjects) and undiluted test material was not an irritant or sensitizer in a provocative RIPT (20 eczema patients) - 10% active was not irritating to rabbit eyes	19
Cetearyl Nonanoate	safe as used (2010)	- the oral LD_{50} in rats was 2 g/kg - the acute dermal LD_{50} in rats was >2 g/kg and there was no dermal irritation observed - undiluted test material (97% pure) was non-irritating to rabbit skin; not a sensitizer in a GPMT (10% for intracutaneous induction, 50% for topical induction, 10% at challenge, sesame oil was the vehicle) - not mutagenic in an Ames test at doses up to 5000 µg/plate with or without metabolic activation - in human testing, undiluted test material (97% pure) was not an irritant in a 48-h SIOPT (52 subjects); undiluted test material was not an irritant or a sensitizer in a RIPT (106 subjects) - undiluted test material was minimally irritating to rabbit eyes	19
Cetyl Isononanoate	safe as used (2010)	- no data were available	19
Ethylhexyl Isononanoate	safe as used (2010)	- not mutagenic in an Ames test at doses up to 5000 µg/plate with or without metabolic activation - in human testing, undiluted test material did not indicate potential for allergic contact sensitization in an RIPT (10 subjects)	19
Ethylhexyl Pelargonate	safe as used (2010)	- the acute oral LD_{50} in rats was >5 g/kg - undiluted test material was not irritating to rabbit skin (PII = 0.40) - undiluted test material was not irritating to rabbit eyes	19
Isobutyl Pelargonate	safe as used (2010)	- no data were available	19
Isodecyl Isononanoate	safe as used (2010)	- in human testing, a formulation containing 51.35% was not an irritant or sensitizer in a RIPT (101 subjects) and a formulation containing 2.6% was not a contact allergen in a maximization test (26 subjects)	19
Isononyl Isononanoate	safe as used (2010)	- the acute oral LD_{50} in rats was >5 g/kg; 300 and 1000 mg/kg/day induced mortality and all doses (100-1000mg/kg/day) induced liver and kidney toxicity in a 4-wk oral study in rats - 300 mg/kg/day (2 wks) and 860 mg/kg/day (8 days) induced liver and adrenal gland toxicity in a dermal study in rats - not embryotoxic or fetotoxic in rats dosed by gavage with 300 mg/kg/day on days 6-17 post-coitum - not mutagenic in an Ames test at doses up to 5000 µg/plate with or without metabolic activation - slightly irritating to rabbit skin (study details not provided) - in human testing, lipstick formulations containing 3.552% (53 subjects) and 3.128% (97 subjects) were not irritants or sensitizers in RIPTs and a formulation containing 24.66% was not a contact allergen in a maximization test (26 subjects) - not irritating to rabbit eyes (concentration tested was not stated)	19
Isostearyl Isononanoate	safe as used (2010)	-no data were available	19
Isotridecyl Isononanoate	safe as used (2010)	- in human testing, a formulation containing 4.3% was not a contact allergen in a maximization test (28 subjects)	19
Tridecyl Isononanoate	safe as used (2010)	- no data were available	19
Final report on the safety assessment of cetyl esters			
Cetyl Esters	safe as used (1997)	- (synonymous with synthetic spermaceti wax) a commercial cetyl esters preparation comprised of a mixture of one or more of the following esters: cetyl palmitate, myristyl myristate, cetyl stearate, myristyl stearate, cetyl myristate, and stearyl stearate - the oral LD_{50} in mice of a formulation containing 60-65% >20 g/kg - a formulation containing 60-65% was not irritating to rabbit skin in a 24 h SIOPT - a formulation containing 60-65% was not an irritant to rabbit eyes Discussion item: data from the safety assessments on cetyl palmitate, myristyl myristate, cetyl stearate, and myristyl stearate were extrapolated to determine safety	1
Final report on the safety assessment of octyl palmitate, cetyl palmitate, and isopropyl palmitate			
Cetyl Palmitate	safe as used (1982; reaffirmed in 2005)	- was quantitatively excreted in the feces of male rats when fed at 20% in the diet - acute oral LD_{50} was > 14.4 g/kg in rats; not toxic in a 9-day dietary study in rats - no mortality was observed when a 50% slurry was applied to rabbit skin under an occlusive patch - was at most mildly irritating in rabbits when applied undiluted or in formulation (2.5-2.7%) under occlusion; a 1% suspension produced minimal irritation and was not sensitizing in the Landsteiner and Jacobs test in guinea pigs	5,9

Table 2. Conclusions (year issued) and data summaries of previously reviewed alkyl esters

Alkyl Ester	Conclusion (Year)	Summary data	Reference
		- in humans, a formulation containing 2.7% was not a primary irritant (10 subjects); in maximization studies, a formulation containing 2.5% was classified as a weak potential sensitizer that was unlikely to present a risk of contact sensitization under conditions of normal use (50 subjects) and one containing 2.7% was classified as a weak potential sensitizer of the lowest grade (25 subjects); a formulation containing 2.7% was not phototoxic (10 subjects) or photoallergenic (25 subjects); low irritation potential was observed in in-use studies (28-56 days; 30-100 subjects per study) - minimally irritating to rabbit eyes; OIIs ranged from 0.3 – 6.7 for undiluted test material and 0.0 for a 5% (w/w) dispersion	
Ethylhexyl Palmitate (originally, Octyl Palmitate)	safe as used (1982; reaffirmed in 2005)	- the acute oral LD_{50} was >64 ml/kg in rats - the acute dermal LD_{50} was >9.4 ml/kg in rabbits (only 2 rabbits in each group); dermal toxicity was not observed in a 6 wk dermal study with undiluted material; undiluted test material was "poorly tolerated" in a 60-day study with "congestive dermatitis" in 2/3 rabbits - was a mild irritant tested undiluted in an SIOPT in rabbits; 0.1% suspensions were not sensitizers in the Landsteiner and Jacobs test in guinea pigs - in human studies, 3 formulations containing 1-5% and one containing 40-50% tested in 48-h occlusive tests with 100 subjects and 3 formulations containing 45.72-46.52% tested in an 18 day occlusive RIPT with 20 subjects were not irritants, and in a 21-day occlusive RIPT a formulations containing 42.25% resulted in signs of irritation in 7/24 subjects and the avg. cumulative irritation score was 2.58/84 - OIIs for undiluted test material ranged from 0.33 – 4.17 in 3 Draize studies, indicating that it did not cause significant injury to rabbit eyes	5,9
Isopropyl Palmitate	safe as used (1982; reaffirmed in 2005)	- the acute oral LD_{50} was >64 ml/kg in rats - the dermal LD_{50} was >2.0 ml/kg in rabbits - no inhalation toxicity in rats exposed to 200mg/l for 1 h - undiluted test material was non-irritating to slightly irritating to rabbit skin - in human testing, in 3 studies with 24-h occlusive patches with undiluted test material performed in a total of 160 subjects, there were five irritation scores of 0.5/4, and the remainder were 0/4 and in a 10-day primary irritation study, a formulation containing 45.6% was not irritating in 10 subjects; not a sensitizer when tested undiluted in an RIPT with 102 subjects or in formulation at 45.6% in a maximization test with 25 subjects; a formulation containing 45.6% was not phototoxic (10 subjects) or photoallergenic (25 subjects) - OIIs ranged from 0.0 – 6.5 in 5 Draize studies, indicating that it did not cause significant injury to rabbit eyes	5,9
Final report on the safety assessment of Ricinus communis (castor) seed oil, hydrogenated castor oil, glyceryl ricinoleate, glyceryl ricinoleate se, ricinoleic acid, potassium ricinoleate, sodium ricinoleate, zinc ricinoleate, cetyl ricinoleate, ethyl ricinoleate, glycol ricinoleate, isopropyl ricinoleate, methyl ricinoleate, and octyldodecyl ricinoleate			
		- Discussion item: safety test data on Ricinus Communis (Castor) Seed Oil, which contains ricinoleic acid (and for which data were included), was considered applicable for extrapolation to determine safety; retrospective study reports of sensitization reactions to ricinoleic acid in patients with eczematous cheilitis was determined to be expected in that patient group but not the general population, and based on the Panel's expertise and experience, the incidence of positive reactions to ricinoleic acid were very low	
Cetyl Ricinoleate	safe as used (2007)	- the acute oral LD_{50} in mice was >2 g/kg - not irritating to rabbit skin (test concentration not stated)	20
Isopropyl Ricinoleate	safe as used (2007)	- no specific safety data were available	20
Octyldodecyl Ricinoleate	safe as used (2007)	- no specific safety data were available	20
Final report on the safety assessment of Cocos nucifera (coconut) oil and related ingredients			
		Discussion items: because there is no reason to expect the toxicity to differ from that of coconut oil, coconut acid, hydrogenated coconut oil, and hydrogenated coconut acid and therefore the data available on these ingredients are supportive of safety; necessary procedures should be continued by the cosmetics industry to limit pesticide residues and heavy metals	
Decyl Cocoate	safe as used (2011)	- no data were available	17
Ethylhexyl Cocoate	safe as used (2011)	- no data were available	17
Isodecyl Cocoate	safe as used (2011)	- no data were available	17
Lauryl Cocoate	safe as used (2011)	- no data were available	17
Octyldodecyl Cocoate	safe as used (2011)	- no data were available	17
Tridecyl Cocoate	safe as used (2011)	- no data were available	17
Final report on the safety assessment of decyl and isodecyl oleates			
Decyl Oleate	safe as used (1982; reaffirmed in 2003)	- the acute oral LD_{50} was > 40 ml/kg and >5 g/kg in rats - in a primary dermal irritation study using rabbits, the PIIs for a 10% solution in corn oil, and 20% solution in mineral oil, and undiluted test material were 0.08, 0.05, and 0.28, respectively, and in a modified Draize test, a 15% solution in polyoxyethylene sorbitan stearate (3%), preservative (2%), and water and undiluted test material were non-irritating; in an 8-wk study in rabbits, daily application of the 15% solution produced some papulae or vesicles but was generally well tolerated and the undiluted material resulted in skin thickening in 3 rabbits (total tested not stated) and vesicles in 1 rabbit and was poorly tolerated; a 15% solution in corn oil was not a sensitizer in the Landsteiner and Jacobs test in guinea pigs - in human testing, no sensitization was reported in a RIPT in 103-subject with a formulation containing 1-5% or in 402 subjects with 4 formulations containing 5.5%	4,23

Table 2. Conclusions (year issued) and data summaries of previously reviewed alkyl esters

Alkyl Ester	Conclusion (Year)	Summary data	Reference
		- at most, a very slight irritant to rabbit eyes when tested undiluted	
Isodecyl Oleate	safe as used (1982; reaffirmed in 2003)	- the acute LD_{50} was > 40 ml/kg in rats - undiluted test material had a PII of 1.0 in 3 rabbits, but subsequent testing reported a PII of 0.28 and additional studies with a 15% solution in polyoxyethylene sorbitan stearate (3%), preservative (2%), and water indicated the material was non-irritating (PII scores of 0.0 and 0.13 for the undiluted material and 0.0 for the 15% solution); in an 8-wk study in rabbits, daily application of the 15% solution produced episodical macules, papulae, and vesicles but was relatively well tolerated and the undiluted material was poorly tolerated with congestive dermis effects; a 15% solution in corn oil was not a sensitizer in the Landsteiner and Jacobs test in guinea pigs - in humans, undiluted test material was not an irritant in an SIOPT in 19 subjects and in a 21-day cumulative irritancy test in 9 subjects with undiluted material, the irritation score was 1.0/756 - at most, a very slight irritant to rabbit eyes when tested undiluted	4,23
Final report on the safety assessment of isopropyl isostearate			
Isopropyl Isostearate	safe as used (1992, reaffirmed in 2011)	- undiluted test material was a non-irritant (PII = 0.42) in rabbit skin 24 and 72 h after application, and in an 8-wk study a 10% aq. solution was relatively well tolerated (IIMM = 2.00) but the undiluted material was poorly tolerated (IIMM = 3.34) and discontinued after 5 wks; undiluted test material induced severe comedones in rabbit ears - 10% aq. and undiluted test material were slight ocular irritants in rabbit eyes Discussion item: because limited toxicological data (dermal irritation, ocular irritation, and comedogenicity data) were available, the Panel used data on similar isopropyl esters that had already been reviewed and found safe to determine safety	2,8
Final report on the safety assessment of isopropyl linoleate			
Isopropyl Linoleate	insufficient to support safety (1992)	- the oral LD_{50} in rats of 10% in corn oil was >64 cc/kg - 10% aq. and undiluted test material were classified as slightly irritant and non-irritant, respectively, in primary irritation studies in rabbits; both 10% aq. and undiluted test materials were slight irritants when the study was repeated with purer samples; in another primary skin irritation study, 10% in corn oil did not product any irritation reactions in albino rabbits - 10% aq. and undiluted test material were slight ocular irritants, while 10% in corn oil was not irritating to rabbit eyes Discussion item: human irritation and sensitization data and genotoxicity data were needed	15
Final report on the safety assessment of isostearyl neopentanoate			
Isostearyl Neopentanoate	safe as used (1985, reaffirmed in 2006)	- the acute oral LD_{50} was >40 ml/kg in rats; in a 93 day study, oral administration of undiluted test material in rats was safe in terms of cumulative systemic toxicity - undiluted test material applied under a 24 h patch was not irritating to rabbit skin and formulations containing 1.2 – 32% was a most mildly irritating in rabbits; not considered a sensitizer in a GPMT (observations were attributed to scratches) and not a sensitizer in the Landsteiner and Jacobs test in guinea pigs; a formulation containing 3% was a mild primary skin irritant but was not phototoxic; 50% in mineral oil was marginally comedogenic and undiluted was non-comedogenic in rabbit ears - in human testing, was non-irritating in a 48-h SIOPT when tested undiluted or in formulations containing 3-5% (10 or 100 subjects), 4% in formulation (20 subjects) was minimally irritating (PII = 0.08) and 1.2% in formulation was non-irritating (20 subjects) in a 24-h SIOPT, a formulation containing 3% was mildly irritating in a 21-day study (15 subjects); undiluted test material and formulations containing 5-32% were not sensitizers in RIPT studies (52-210 subjects per study), although some irritation was reported; a formulation containing 16.05% was not phototoxic or a photoallergen in 27 subjects - undiluted test material was minimally irritating in rabbit eyes and formulations containing 1.2 – 36% were at most minimally irritating Discussion items: because of the skin penetration enhancement property of pelargonic acid in the presence of p-aminobenzoic acid, care should be taken in formulating products containing this ingredient in combination with any ingredients whose safety was based on lack of dermal absorption or when dermal absorption was a concern	6,12
Final report on stearyl heptanoate and related stearyl alkanoates as used in cosmetics ***Final report on the safety assessment of stearyl heptanoate***			
		Discussion items: data from the original review on stearyl heptanoate were applicable to determine safety, including extrapolated data on stearyl alcohol and heptanoic acid	18
Stearyl Behenate	safe as used (2010)	- no data were available	18
Stearyl Caprylate	safe as used (2010)	- no data were available	18
Stearyl Heptanoate	safe as used (1995, reaffirmed 2010)	- the oral LD_{50} in rats was >16 ml/kg - a mixture that also contained stearyl caprylate was not mutagenic in an Ames test with or without metabolic activation and had no clastogenic effect in an *in vivo* micronucleus test in which mice were given a single oral dose of 500-1500 mg/kg in corn oil - undiluted test material was mildly irritating to rabbit skin (PII = 1.21/8); a formulation containing 1.5% was not a sensitizer in guinea pigs; a formulation containing 1.5% produced slight to moderate comedogenicity in rabbit ears - in human testing, cosmetic formulations containing 0.7% (198 subjects) and 1.5% (156, 194, and 202 subjects) were not sensitizers in RIPTs - undiluted test material was a Category 3 ocular irritant in rabbit eyes and a formulation containing 1.5% was not a primary ocular irritant Discussion items: although irritation testing was performed at 100%, sensitization testing was only performed with a maximum concentration of 1.5%; however, there was no indication that this ingredient would be a sensitizer; mild reactions were observed in ocular irritation studies with	3,18

Table 2. Conclusions (year issued) and data summaries of previously reviewed alkyl esters

Alkyl Ester	Conclusion (Year)	Summary data	Reference
		undiluted material and no irritation with a formulation containing 1.5%, therefore the Panel was of the opinion that in formulation, this ingredient would not produce significant ocular irritation; because there was limited information available, data on stearyl alcohol and heptanoic acid were extrapolated to determine safety	
Stearyl Olivate	safe as used (2010)	- no data were available	18
Stearyl Palmitate	safe as used (2010)	- no data were available	18
Stearyl Stearate	safe as used (2010)	- no data were available	18

Abbreviations: GPMT = guinea pig maximization test; IIMM = maximum irritation index; OII =ocular irritation index; PII = primary irritation index; RIPT = repeated insult patch test; SIOPT = single insult occlusive patch test

Table 3. Alkyl Esters Group (grouped by whether individual constituents have been reviewed)

INGREDIENTS HAVE BEEN REVIEWED BY THE CIR AND FOUND SAFE*			
Arachidyl Propionate	Ethylhexyl Isononanoate	Isopropyl Isostearate	Octyldodecyl Cocoate
Butyl Myristate	Ethylhexyl Myristate	Isopropyl Myristate	Octyldodecyl Myristate
Butyl Stearate	Ethylhexyl Palmitate	Isopropyl Palmitate	Octyldodecyl Ricinoleate
Cetearyl Isononanoate	Ethylhexyl Pelargonate	Isopropyl Ricinoleate	Oleyl Myristate
Cetearyl Nonanoate	Ethylhexyl Stearate	Isopropyl Stearate	Stearyl Behenate
Cetyl Esters	Isobutyl Myristate	Isostearyl Isononanoate	Stearyl Caprylate
Cetyl Isononanoate	Isobutyl Perlargonate	Isostearyl Myristate	Stearyl Heptanoate
Cetyl Myristate	Isobutyl Stearate	Isostearyl Neopentanoate	Stearyl Olivate
Cetyl Palmitate	Isocetyl Myristate	Isotridecyl Isononanoate	Stearyl Palmitate
Cetyl Ricinoleate	Isocetyl Stearate	Isotridecyl Myristate	Stearyl Stearate
Cetyl Stearate	Isodecyl Cocoate	Lauryl Cocoate	Tetradecyloctadecyl Myristate
Decyl Cocoate	Isodecyl Isononanoate	Lauryl Myristate	Tridecyl Cocoate
Decyl Myristate	Isodecyl Myristate	Myristyl Myristate	Tridecyl Isononanoate
Decyl Oleate	Isodecyl Oleate	Myristyl Stearate	Tridecyl Myristate
Ethylhexyl Cocoate	Isononyl Isononanoate		
BOTH THE ACID *AND* THE ALCOHOL HAVE BEEN FOUND SAFE BY THE CIR			
Batyl Isostearate	Cetearyl Stearate	Isostearyl Hydroxystearate	Myristyl Isostearate
Batyl Stearate	Cetyl Laurate Cetyl Oleate	Isostearyl Isostearate	Myristyl Laurate
Behenyl Isostearate	Chimyl Isostearate	Isopropyl Hydroxystearate	Octyldodecyl Hydroxystearate
Behenyl Olivate	Chimyl Stearate	Isopropyl Laurate	Octyldodecyl Isostearate
Butyl Isostearate	Hydrogenated Castor Oil Behenyl Esters	Isopropyl Oleate	Octyldodecyl Oleate
Butyl Oleate	Hydrogenated Castor Oil Cetyl Esters	Isostearyl Hydroxystearate	Octyldodecyl Olivate
Cetearyl Olivate	Hydrogenated Castor Oil Stearyl Esters	Isostearyl Isostearate	Octyldodecyl Stearate
Cetearyl Palmate	Isopropyl Hydroxystearate	Isostearyl Laurate	Oleyl Oleate
Cetearyl Palmitate	Isopropyl Laurate	Isostearyl Palmitate	Oleyl Stearate
Cetearyl Rice Branate	Isopropyl Oleate		
THE ACID *OR* THE ALCOHOL HAS BEEN FOUND SAFE BY THE CIR			
Behenyl Beeswax	**Coco**-Rapeseedate	Isoamyl **Laurate**	Lauryl **Laurate**
Behenyl Behenate	Decyl **Isostearate**	Isobutyl **Palmitate**	Lauryl **Oleate**
Behenyl Erucate	Decyl **Laurate**	Isocetyl **Isostearate**	Lauryl **Palmitate**
Behenyl/Isostearyl Beeswax	Decyl **Palmitate**	Isocetyl **Laurate**	Lauryl **Stearate**
Butyl Avocadate	Decyltetradecyl **Cetearate**	Isocetyl **Palmitate**	**Myristyl** Neopentanoate
Butyl Babassuate	Ethylhexyl **Adipate/Palmitate/Stearate**	Isodecyl **Hydroxystearate**	Octyldecyl **Oleate**
Butyloctyl **Cetearate****	Ethylhexyl **Hydroxystearate**	Isodecyl **Laurate**	**Octyldodecyl** Avocadoate
Butyloctyl **Oleate**	Ethylhexyl **Isostearate**	Isodecyl **Palmitate**	**Octyldodecyl** Beeswax
Butyloctyl **Palmitate**	Ethylhexyl **Laurate**	Isodecyl **Stearate**	**Octyldodecyl** Behenate
C16-36 Alkyl **Stearate**	Ethylhexyl **Oleate**	Isohexyl **Laurate**	**Octyldodecyl** Erucate
C20-40 Alkyl **Stearate**	Erucyl **Oleate**	Isohexyl **Palmitate**	**Octyldodecyl** Meadowfoamate
C30-50 Alkyl **Stearate**	Heptylundecyl **Hydroxystearate**	Isooctyl **Tallate**	**Octyldodecyl** Neodecanoate
C40-60 Alkyl **Stearate**	Hexyldecyl **Isostearate**	**Isopropyl** Arachidate	**Octyldodecyl** Neopentanoate
Cetearyl Behenate	Hexyldecyl **Laurate**	**Isopropyl** Avocadate	**Octyldodecyl** Octyldodecanoate
Cetearyl Candelillate	Hexyldecyl **Oleate**	**Isopropyl** Babassuate	**Octyldodecyl** Safflowerate
Cetyl Babassuate	Hexyldecyl **Palmitate**	**Isopropyl** Behenate	**Oleyl** Arachidate
Cetyl Behenate	Hexyldecyl **Stearate**	**Isopropyl** Jojobate	**Oleyl** Erucate
Cetyl Caprate	Hexyldodecyl/Octyldecyl **Hydroxystearate**	**Isopropyl** Tallowate	**Oleyl** Linoleate
Cetyl Caprylate	Hexyl **Isostearate**	**Isostearyl** Avocadate	**Stearyl** Beeswax
Cetyl Dimethyloctanoate	Hexyl **Laurate**	**Isostearyl** Behenate	**Stearyl** Erucate
Cetyl Tallowate	**Hydrogenated** Ethylhexyl **Olivate**	**Isostearyl** Erucate	**Stearyl** Linoleate
C10-40 Isoalkyl Acid **Octyldodecanol** Esters	**Hydrogenated** Ethylhexyl **Sesamate**	**Isostearyl** Linoleate	Tetradecyleicosyl **Stearate**
C4-5 Isoalkyl **Cocoate**	Hydrogenated Isocetyl **Olivate**	Isotridecyl **Laurate**	Tetradecyloctadecyl **Stearate**
C32-36 Isoalkyl **Stearate**	Hydrogenated **Isopropyl** Jojobate	Isotridecyl **Stearate**	Tridecyl **Laurate**
Coco-Caprylate	Hydroxycetyl **Isostearate**	Lauryl **Isostearate**	Tridecyl **Stearate**
Coco-Caprylate/Caprate	Hydroxyoctacosanyl **Hydroxystearate**		

Table 3. Alkyl Esters Group (grouped by whether individual constituents have been reviewed)

CIR HAS NOT CONCLUDED ON THE SAFETY OF THE ACID OR THE ALCOHOL			
Arachidyl Behenate	Caprylyl Butyrate	Erucyl Erucate	Isooctyl Caprylate/Caprate
Arachidyl Erucate	Caprylyl Caprylate	Heptyldecyl Undecylenate	Lauryl Behenate
Butyloctyl Beeswax	Caprylyl Eicosenoate	Hexyldecyl Hexyldecanoate	Lignoceryl Erucate
Butyloctyl Behenate	Decyl Castorate	Isobutyl Tallowate	Propylheptyl Caprylate
Butyloctyl Candelillate	Decyl Jojobate	Isocetyl Behenate	Tetradecyloctadecyl Behenate
C14-30 Alkyl Beeswax	Ethylhexyl C10-40 Isoalkyl Acidate	Isocetyl Isodecanoate	Tetradecyloctadecyl Hexyldecanoate
C18-38 Alkyl Beeswax	Ethylhexyl Isopalmitate	Isodecyl Neopentanoate	Tetradecylpropionates
C30-50 Alkyl Beeswax	Ethylhexyl Neopentanoate	Isohexyl Caprylate	Tridecyl Behenate
C20-40 Alkyl Behenate	Ethylhexyl Olivate	Isohexyl Neopentanoate	Tridecyl Erucate
C18-38 Alkyl C24-54 Acid Ester	Erucyl Arachidate	Isolauryl Behenate	Tridecyl Neopentanoate

*Isopropyl Linoleate was reviewed previously by the CIR, with a conclusion of insufficient data to support safety

**the acid component is a mixture of fatty acids, containing predominantly palmitic and stearic acids, both of which have been reviewed

Table 4. Constituent alcohols and acids with CIR conclusions

Constituent	Conclusion (year issued; maximum use concentration reported)	Reference
ALCOHOLS		
Batyl Alcohol	safe as used (2011; 3% in leave-ons, 1% in rinse-offs)	55
Behenyl Alcohol	safe as used (1988; reaffirmed 2008; 50% in leave-ons; 10% in rinse-offs)	7,56
Butyl Alcohol	safe as used (2008; 15% in leave-ons; ≤0.1% in rinse-offs)	57
Cetearyl Alcohol	safe as used (1988; reaffirmed 2008; 25% in leave-ons; 25% in rinse-off)	7,56
Cetyl Alcohol	safe as used (1988; reaffirmed 2008; 50% in leave-ons; 25% in rinse-offs)	7,56
Cetyl Glycol (Hydroxycetyl Alcohol)	safe as used (2011; no reported use)	58
Chimyl Alcohol	safe as used (2011; 0.5% in leave-ons, 0.002% in rinse-offs)	55
Coconut Alcohol	safe as used (2011; 0.9% in leave-ons; 0.8% in rinse-offs)	17
Isopropyl Alcohol	safe as used (2012; 100% in leave-ons; 35% in rinse-offs)	59
Isostearyl Alcohol	safe as used (1988; reaffirmed 2008; 50% in leave-ons; 5% in rinse-offs)	7,56
Jojoba Alcohol	safe as used (2008; 1% in leave-ons; 0.5% in rinse-offs)	60
Myristyl Alcohol	safe as used (1988; reaffirmed 2008; 12% in leave-ons; 7% in rinse-offs)	7,56
Octyldodecanol	safe as used (1985, reaffirmed 2006; 85% in leave-ons; 30% in rinse-offs)	6,61
Oleyl Alcohol	safe as used (1985; reaffirmed 2006; >50% in leave-ons; 25% in rinse-offs)	6,61
Stearyl Alcohol	safe as used (1985; reaffirmed 2006; 56% in leave-ons; 25% in rinse-offs)	6,61
ACIDS		
Adipic Acid	safe as used (2012; 0.000001% in leave-on; 18% in rinse-off)	62
Babassu Acid	safe as used (2011; no reported use)	63
Coconut Acid	safe as used (2011; not reported in leave-ons; 14% in rinse-offs)	17,63
Hydroxystearic Acid	safe as used (1999; 10% in leave-ons; not reported for rinse-offs)	64
Isostearic Acid	safe as used (1983; reaffirmed in 2005; 16% in leave-ons, 26% in rinse-offs)	5,65
Lauric Acid	safe as used (1987; reaffirmed in 2006; 10% in leave-ons, 25% in rinse-offs)	6,66
Myristic Acid	safe as used (2010; 15% in leave-ons; 50% in rinse-offs)	16
Oleic Acid	safe as used (1987; reaffirmed in 2006; 25% in leave-ons; 50% in rinse-offs)	6,66
Olive Acid	safe as used (2011; no reported use)	63
Palm Acid	safe as used (2011; not reported in leave-ons; 17% in rinse-offs)	63
Palmitic Acid	safe as used (1987; reaffirmed in 2006; 25% in leave-ons, 25% in rinse-offs)	6,66
Pelargonic Acid	safe as used (2011; no reported use)	19
Rice Bran Acid	safe as used (2011; no reported use)	63
Ricinoleic Acid	safe as used (2007; use concentration not reported)	20
Safflower Acid	safe as used (2011; no reported use)	63
Stearic Acid	safe as used (1987; reaffirmed in 2006; >50% in leave-ons; 50% in rinse-offs)	6,66
Tall Oil Acid	safe as used (2009; not reported in leave-ons; 8% in rinse-offs)	67

Table 5. Definitions and functions

Ingredient/CAS No.	Definition[24] (italicized text generated by CIR)	Function[24]
Arachidyl Behenate 42233-14-7	the ester of arachidyl alcohol and behenic acid. *The ester obtained from the reaction of arachidyl alcohol with behenic acid.*	skin cond. agent – oc.; visc. incr. agent – nonaq.
Arachidyl Erucate 86601-86-7	the ester of arachidyl alcohol and erucic acid. *The ester obtained from the reaction of arachidyl alcohol with erucic acid.*	skin cond. agent – emol.
Arachidyl Propionate 65591-14-2	the ester of arachidyl alcohol and n-propionic acid. *The ester obtained from the reaction of arachidyl alcohol and n-propionic acid.*	skin cond. agent – emol.
Batyl Isostearate 170754-20-8	an ester of Batyl Alcohol and Isostearic Acid. *The mixture of esters obtained from the reaction of batyl alcohol with branched-chain stearic acids.*	skin cond. agent – oc.

Table 5. Definitions and functions

Ingredient/CAS No.	Definition[24] (italicized text generated by CIR)	Function[24]
Batyl Stearate 13232-26-3	an ester of Batyl Alcohol and stearic acid. *The ester obtained from the reaction of batyl alcohol with stearic acid.*	skin cond. agent – oc.
Behenyl Beeswax	the ester of Behenyl Alcohol and Beeswax Acid. *The mixture of esters obtained from the reaction of behenyl alcohol with a mixture of straight-chain fatty acids, containing 24 to 36 carbons in alkyl chain length (beeswax acid).*	skin cond. agent – oc.
Behenyl Behenate 17671-27-1	the ester of Behenic Acid and Behenyl Alcohol. *The ester obtained from the reaction of behenic acid with behenyl alcohol.*	skin cond. agent – oc.
Behenyl Erucate 18312-32-8	the ester of Behenyl Alcohol and erucic acid. *The ester obtained from the reaction of behenyl alcohol with erucic acid.*	skin cond. agent – oc.
Behenyl Isostearate 181496-25-3	the ester of Behenyl Alcohol and isostearic acid that conforms to the formula. *The mixture of esters obtained from the reaction of behenyl alcohol with branched-chain stearic acids.*	skin cond. agent – oc.
Behenyl/Isostearyl Beeswax	the ester of a mixture of Behenyl Alcohol and Isostearyl Alcohol with Beeswax Acid. *The mixture of esters obtained from the reaction of behenyl alcohol and branched-chain stearyl alcohols with a mixture of straight-chain fatty acids, containing 24 to 36 carbons in alkyl chain length (beeswax acid).*	skin cond. agent – oc.
Behenyl Olivate	the ester of behenyl alcohol and Olive Acid that conforms generally to the formula. *The mixture of esters obtained from the reaction of behenyl alcohol with the fatty acids derived from olive acid.*	skin cond. agent – misc.; emul. stabilizer; film former; slip modifier; visc, incr. agent – nonaq.
Butyl Avocadate	the ester of butyl alcohol and the fatty acids derived from Persea Gratissima (Avocado) Oil. *The mixture of esters obtained from the reaction of butyl alcohol with the fatty acids derived from Persea Gratissima (Avocado) Oil.*	skin cond. agent – misc.
Butyl Babassuate	the ester of butyl alcohol and the fatty acids derived from babassu oil. *The mixture of esters obtained from the reaction of butyl alcohol with the fatty acids derived from babassu oil.*	disp. agent-nonsurf.; emul. stab.; skin cond, agent -emol; surf.-solub. agent
Butyl Isostearate	the ester of butyl alcohol and isostearic acid that conforms to the formula. *The mixture of esters obtained from the reaction of butyl alcohol with branched-chain stearic acids.*	skin cond, agent -emol
Butyl Myristate 110-36-1	the ester of butyl alcohol and myristic acid. *The ester obtained from the reaction of butyl alcohol with myristic acid.*	skin cond, agent -emol
Butyl Oleate 142-77-8	the ester of butyl alcohol and oleic acid. *The ester obtained from the reaction of butyl alcohol with oleic acid.*	skin cond, agent –emol.; fragrance ingr.
Butyl Stearate 123-95-5	the ester of butyl alcohol and stearic acid. *The ester obtained from the reaction of butyl alcohol and stearic acid.*	skin cond, agent –emol.; fragrance ingr.
Butyloctyl Beeswax 151661-98-2	the ester of Butyloctanol and Beeswax Acid. *The mixture of esters obtained from the reaction of 2-butyloctanol with a mixture of straight-chain fatty acids, containing 24 to 36 carbons in alkyl chain length (beeswax acid).*	skin cond. agent – oc.
Butyloctyl Behenate	the organic compound that conforms to the formula. *The ester obtained from the reaction of 2-butyloctanol with behenic acid.*	skin cond. agent – emol.
Butyloctyl Candelillate 226994-03-2	the ester of 2-butyloctanol and the acids derived from Euphorbia Cerifera (Candelilla) Wax. *The mixture of esters obtained from the reaction of 2-butyloctanol with the fatty acids derived from Euphorbia Cerifera (Candelilla) Wax.*	skin cond. agent – oc.
Butyloctyl Cetearate 101227-08-1	the ester of Butyloctanol and a blend of fatty acids containing predominantly palmitic and stearic acid. *The mixture of esters obtained from the reaction of 2-butyloctanol with a mixture of fatty acids containing predominately palmitic acid and stearic acid.*	skin cond. agent – emol.
Butyloctyl Oleate	the ester of butyloctanol and oleic acid. *The ester obtained from the reaction of 2-butyloctanol with oleic acid.*	skin cond. agent – oc.
Butyloctyl Palmitate	the ester of Butyloctanol and Palmitic Acid. *The ester obtained from the reaction of 2-butyloctanol with palmitic acid.*	skin cond. agent – emol.
C14-30 Alkyl Beeswax 209225-40-1	the ester of a mixture of fatty alcohols containing 14 to 30 carbons in the alkyl chain with Beeswax Acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 14 to 30 carbons in the alkyl chain, with a mixture of straight-chain fatty acids, containing 24 to 36 carbons in alkyl chain (beeswax acid).*	skin cond. agent – oc.
C18-38 Alkyl Beeswax 223706-17-0	the ester of a mixture of fatty alcohols containing 18 to 38 carbon atoms in the alkyl chain and Beeswax Acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 18 to 38 carbons in the alkyl chain, with a mixture of straight-chain fatty acids, containing 24 to 36 carbons in alkyl chain (beeswax acid).*	skin cond. agent – oc.
C30-50 Alkyl Beeswax 223707-19-5	the ester of C30-50 Alcohols and Beeswax Acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 30 to 50 carbons in the alkyl chain, with a mixture of straight-chain fatty acids, containing 24 to 36 carbons in alkyl chain (beeswax acid).*	skin cond. agent – oc.
C20-40 Alkyl Behenate	the ester of C20-40 Alcohols and behenic acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 20 to 40 carbons in the alkyl chain, with behenic acid.*	skin cond. agent – oc.
C18-38 Alkyl C24-54 Acid Ester	the ester of a mixture of fatty alcohols containing 18 to 38 carbon atoms and a mixture of fatty acids containing 24 to 54 carbon atoms. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 30 to 50 carbons in the alkyl chain, with a mixture of straight-chain fatty acids, containing 24 to 54 carbons in alkyl chain.*	visc. incr. agent – nonaq.
C16-36 Alkyl Stearate	the ester of C16-36 alcohols and Stearic Acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 16 to 36 carbons in the alkyl chain, with stearic acid.*	skin cond. agent – oc.

Table 5. Definitions and functions

Ingredient/CAS No.	Definition[24] (italicized text generated by CIR)	Function[24]
C20-40 Alkyl Stearate	the ester of C20-40 Alcohols and stearic acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 20 to 40 carbons in the alkyl chain, with stearic acid.*	skin cond. agent – oc.; visc. incr. agent-aq.
C30-50 Alkyl Stearate	the ester of C30-50 Alcohols and Stearic Acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 30 to 50 carbons in the alkyl chain, with stearic acid.*	skin cond. agent – oc.
C40-60 Alkyl Stearate	the ester of C40-60 Alcohols and Stearic Acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 40 to 60 carbons in the alkyl chain, with stearic acid.*	skin cond. agent – oc.
Caprylyl Butyrate 110-39-4	the ester of n-octanol with butyric acid that conforms to the formula. *The ester obtained from the reaction of n-octanol with butyric acid.*	skin cond. agent – misc.; fragrance ingredient
Caprylyl Caprylate 2306-88-9	the organic compound that conforms to the formula. *The ester obtained from the reaction of n-octanol with n-octanoic acid.*	skin cond. agent – emol.
Caprylyl Eicosenoate	the organic compound that conforms to the formula. *The ester obtained from the reaction of n-octanol with 11-eicosenoic acid.*	skin cond. agent – misc.
Cetearyl Behenate	the ester of Cetearyl Alcohol and Behenic Acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 16 to 18 carbons in the alkyl chain, with behenic acid.*	skin cond. agent – oc.
Cetearyl Candelillate	the ester of Cetearyl Alcohol and the fatty acids derived from Euphorbia Cerifera (Candelilla) Wax. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 16 to 18 carbons in the alkyl chain, with the fatty acids derived from Euphorbia Cerifera (Candelilla) Wax.*	skin cond. agent – oc.
Cetearyl Isononanoate	the ester of cetearyl alcohol and a branched chain nonanoic acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 16 to 18 carbons in the alkyl chain, with branched chain nonanoic acid.*	skin cond. agent-emol.; hair cond. agent
Cetearyl Nonanoate 878027-13-5	the organic compound that conforms to the formula. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 16 to 18 carbons in the alkyl chain, with nonanoic acid.*	skin cond. agent-emol.
Cetearyl Olivate	the ester of Cetearyl Alcohol and the fatty acids derived from olive oil. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 16 - 18 carbons in the alkyl chain, with the fatty acids derived from olive oil.*	hair cond. agent
Cetearyl Palmate	the ester of Cetearyl Alcohol and Palm Acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 16 to 18 carbons in the alkyl chain, with the fatty acids derived from palm acid.*	skin cond. agent – emol.; emul. stab.
Cetearyl Palmitate 85341-79-3	the ester of Cetearyl Alcohol and palmitic acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 16 to 18 carbons in the alkyl chain, with palmitic acid.*	skin cond. agent-emol.; hair cond. agent
Cetearyl Rice Branate	the ester of Cetearyl Alcohol and Rice Bran Acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 16 to 18 carbons in the alkyl chain, with the fatty acids derived from rice bran acid.*	skin cond. agent – misc.
Cetearyl Stearate 93820-97-4	the ester of Cetearyl Alcohol and stearic acid. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 16 to 18 carbons in the alkyl chain, with stearic acid.*	skin cond. agent – oc.
Cetyl Babassuate 613236-40-1	the ester of cetyl alcohol and the fatty acids derived from Orbignya Oleifera (Babassu) Oil. *The mixture of esters obtained from the reaction of cetyl alcohol with the fatty acids derived from Orbignya Oleifera (Babassu) Oil.*	skin cond. agent – emol.; visc. incr. agent-aq.
Cetyl Behenate 42233-11-4	the ester of that conforms to the formula. *The ester obtained from the reaction of cetyl alcohol with behenic acid.*	skin cond. agent – oc.
Cetyl Caprate	the ester of cetyl alcohol and capric acid. *The ester obtained from the reaction of cetyl alcohol with capric acid.*	skin cond. agent – emol.
Cetyl Caprylate 29710-31-4	the ester of cetyl alcohol and caprylic acid. *The ester obtained from the reaction of cetyl alcohol with caprylic acid.*	skin cond. agent – emol.
Cetyl Dimethyloctanoate	the ester of cetyl alcohol and dimethyloctanoic acid. *The ester obtained from the reaction of cetyl alcohol with dimethyloctanoic acid.*	skin cond. agent – emol.
Cetyl Esters	a synthetic wax intended to be indistinguishable from natural spermaceti wax with regard to composition and properties. It consists of a mixture of esters of 14 to 18 carbon fatty acids and alcohols. *The mixture of esters obtained from the reaction of a mixture of fatty alcohols, containing 14 to 18 carbons in the alkyl chain, with a mixture of straight-chain fatty acids, containing 14 to 18 carbons in the alkyl chain.*	skin cond. agent– emol.
Cetyl Isononanoate 84878-33-1	the ester of cetyl alcohol with a branched chain nonanoic acid. *The mixture of esters obtained from the reaction of cetyl alcohol with branched-chain nonanoic acids.*	skin cond. agent – emol.
Cetyl Laurate 20834-06-4	the ester of cetyl alcohol and lauric acid that conforms to the formula. *The ester obtained from the reaction of cetyl alcohol with lauric acid*.	skin cond. agent – emol.
Cetyl Myristate 2599-01-1	the ester of cetyl alcohol and myristic acid. *The ester obtained from the reaction of cetyl alcohol and myristic acid.*	skin cond. agent – oc.
Cetyl Myristoleate	the ester of Cetyl Alcohol and myristoleic acid that conforms to the formula. *The ester obtained from the reaction of cetyl alcohol and myristoleic acid.*	skin cond. agent – misc.
Cetyl Oleate 22393-86-8	the ester of cetyl alcohol and oleic acid. *The ester obtained from the reaction of cetyl alcohol with oleic acid.*	skin cond. agent – emol.
Cetyl Palmitate 540-10-3	the ester of cetyl alcohol and palmitic acid. *The ester obtained from the reaction of cetyl alcohol with palmitic acid.*	skin cond, agent –oc.; fragrance ingr.
Cetyl Ricinoleate 10401-55-5	the ester of cetyl alcohol and ricinoleic acid. *The ester obtained from the reaction of cetyl alcohol with ricinoleic acid.*	skin cond. agent – oc.

Table 5. Definitions and functions

Ingredient/CAS No.	Definition[24] (italicized text generated by CIR)	Function[24]
Cetyl Stearate 1190-63-2	the ester of cetyl alcohol and stearic acid. *The ester obtained from the reaction of cetyl alcohol with stearic acid.*	skin cond. agent – oc.
Cetyl Tallowate	the ester of Cetyl Alcohol and Tallow Acid. *The mixture of esters obtained from the reaction of cetyl alcohol with the fatty acids derived from tallow acid.*	skin cond. agent – misc.
Chimyl Isostearate	the ester of Chimyl Alcohol and isostearic acid. *The mixture of esters obtained from the reaction of cetyl glyceryl ether with branched-chain stearic acids.*	skin cond. agent – emol.
Chimyl Stearate 131932-18-8	the ester of Chimyl Alcohol and stearic acid. *The ester obtained from the reaction of cetyl glyceryl ether with stearic acid.*	skin cond. agent – emol.
C10-40 Isoalkyl Acid Octyldodecanol Esters	a mixture of esters of Octyldodecanol with branched-chain alkyl acids containing 10 to 40 carbons. *The mixture of esters obtained from the reaction of 2-octyldodecanol with branched-chain fatty acids, containing 10 to 40 carbons in the alkyl chain.*	skin cond. agent – misc.; visc. incr. agent-nonaq.
C4-5 Isoalkyl Cocoate	the ester of a branched, saturated fatty alcohol containing 4 to 5 carbons, with Coconut Acid. *The mixture of esters obtained from the reaction of branched-chain alcohols, containing 4 to 5 carbons, with the fatty acids derived from coconut acid.*	skin cond. agent – emol.
C32-36 Isoalkyl Stearate 68201-22-9	the ester of a branched, saturated fatty alcohol containing 32 to 36 carbons, with stearic acid. *The mixture of esters obtained from the reaction of branched-chain alcohols, containing 32 to 36 carbons, with stearic acid.*	skin cond. agent – emol.
Coco-Caprylate	the organic compound that conforms to the formula. *The mixture of esters obtained from the reaction of the fatty alcohols derived from coconut alcohol with caprylic acid.*	skin cond. agent – emol.
Coco-Caprylate/Caprate	a mixture of esters of Coconut Alcohol with Caprylic Acid and Capric Acid. *The mixture of esters obtained from the reaction of the fatty alcohols derived from coconut alcohol with a mixture of caprylic acid and capric acid.*	skin cond. agent – emol.
Coco-Rapeseedate	the ester of Coconut Alcohol and the fatty acids derived from Brassica Campestris (Rapeseed) Oil. *The mixture of esters obtained from the reaction of the fatty alcohols derived from coconut alcohol with the fatty acids derived from Brassica Campestris (Rapeseed) Oil.*	skin cond. agent – emol.
Decyl Castorate	the ester of Decyl Alcohol and the fatty acids derived from Ricinus Communis (Castor) Oil. *The mixture of esters obtained from the reaction of decyl alcohol with the fatty acids derived from Ricinus Communis (Castor) Oil.*	skin cond. agent – emol.; emul. stab.
Decyl Cocoate	the ester of Decyl Alcohol and the fatty acids derived from Cocos Nucifera (Coconut) Oil. *The mixture of esters obtained from the reaction of decyl alcohol with the fatty acids derived from Cocos Nucifera (Coconut) Oil.*	skin cond. agent – oc.
Decyl Isostearate 84605-08-3	the ester of decyl alcohol and isostearic acid. *The mixture of esters obtained from the reaction of decyl alcohol with branched-chain stearic acids.*	skin cond. agent – emol.
Decyl Jojobate	the ester of decyl alcohol and the fatty acids derived from Simmondsia Chinensis (Jojoba) Oil. *The mixture of esters obtained from the reaction of decyl alcohol with the fatty acids derived from Simmondsia Chinensis (Jojoba) Oil.*	skin cond. agent – emol.
Decyl Laurate 36528-28-6	the organic compound that conforms to the formula. *The ester obtained from the reaction of decyl alcohol with lauric acid.*	skin cond. agent – emol.
Decyl Myristate 41927-71-3	the ester of decyl alcohol and myristic acid that conforms to the formula. *The ester obtained from the reaction of decyl alcohol with myristic acid.*	skin cond. agent – oc.
Decyl Oleate 3687-46-5	the ester of decyl alcohol and oleic acid. *The ester obtained from the reaction of decyl alcohol with oleic acid.*	skin cond. agent – emol.
Decyl Olivate	the ester of Decyl Alcohol and the fatty acids derived from Olea Europaea (Olive) Oil. *The mixture of esters obtained from the reaction of decyl alcohol with the fatty acids derived from Olea Europaea (Olive) Oil.*	skin cond. agent – oc.
Decyl Palmitate 42232-27-9	the ester of decyl alcohol and palmitic acid that conforms to the formula. *The ester obtained from the reaction of decyl alcohol with palmitic acid.*	skin cond. agent – emol.
Decyltetradecyl Cetearate 97404-34-7	the ester of Decyltetradecanol and a blend of fatty acids containing predominantly palmitic and stearic acid. *The mixture of esters obtained from the reaction of 2-decyltetradecanol with a mixture of fatty acids, containing predominantly palmitic acid and stearic acid.*	skin cond. agent – emol.
Ethylhexyl Adipate/Palmitate/ Stearate	a mixture of esters formed by the reaction of 2-ethylhexyl alcohol with adipic, palmitic, and stearic acids.	skin cond. agent-emol.
Ethylhexyl C10-40 Isoalkyl Acidate	the ester of C10-40 Isoalkyl Acid and 2-ethylhexyl alcohol. *The mixture of esters obtained from the reaction of 2-ethylhexyl alcohol with branched-chain acids, containing 10 to 40 carbons in the alkyl chain.*	skin cond. agent-misc.; visc. incr. agent-nonaq.
Ethylhexyl Cocoate 91052-62-9;92044-87-6	the ester of 2-ethylhexanol and Coconut Acid that conforms to the formula. *The mixture of esters obtained from the reaction of 2-ethylhexyl alcohol with the fatty acids derived from coconut acid.*	skin cond. agent-emol.
Ethylhexyl Hydroxystearate 29383-26-4; 29710-25-6	the ester of 2-ethylhexyl alcohol and 12-hydroxystearic acid. *The ester obtained from the reaction of 2-ethylhexyl alcohol with 12-hydroxystearic acid.*	skin cond. agent-emol.
Ethylhexyl Isononanoate 70969-70-9; 71566-49-9	the ester of 2-ethylhexyl alcohol and a branched chain nonanoic acid. *The mixture of esters obtained from the reaction of 2-ethylhexyl alcohol with branched-chain nonanoic acids.*	skin cond. agent-emol.
Ethylhexyl Isopalmitate 93843-32-4	the ester of 2-ethylhexanol and a branched chain 16 carbon aliphatic acid. *The mixture of esters obtained from the reaction of 2-ethylhexanol with branched-chain palmitic acids.*	skin cond. agent-emol.
Ethylhexyl Isostearate 81897-25-8; 85186-76-1	the ester of 2-ethylhexyl alcohol and isostearic acid. *The mixture of esters obtained from the reaction of 2-ethylhexyl alcohol with branched-chain stearic acids.*	skin cond. agent-emol.
Ethylhexyl Laurate 20292-08-4	the ester of 2-ethylhexyl alcohol and lauric acid. *The ester obtained from the reaction of 2-ethylhexyl alcohol with lauric acid.*	skin cond. agent-emol.

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Ingredient/CAS No.	Definition[24] (italicized text generated by CIR)	Function[24]
Ethylhexyl Myristate 29806-75-5	the ester of 2-ethylhexyl alcohol and myristic acid. *The ester obtained from the reaction of 2-ethylhexyl alcohol with myristic acid.*	skin cond. agent-emol.
Ethylhexyl Neopentanoate	ester of 2-ethylhexanol and neopentanoic acid. *The ester obtained from the reaction of 2-ethylhexanol with neopentanoic acid.*	skin cond. agent-emol.
Ethylhexyl Oleate 26399-02-0	the ester of oleic acid and 2-ethyl hexyl alcohol. *The ester obtained from the reaction of 2-ethylhexyl alcohol with oleic acid.*	skin cond. agent-emol.
Ethylhexyl Olivate	the ester of ethylhexyl alcohol and the fatty acids derived from Olea Europaea (Olive) Oil. *The mixture of esters obtained from the reaction of 2-ethylhexyl alcohol with the fatty acids derived from Olea Europaea (Olive) Oil.*	skin cond. agent-oc.
Ethylhexyl Palmitate 29806-73-3	the ester of 2-ethylhexyl alcohol and palmitic acid. *The ester obtained from the reaction of 2-ethylhexyl alcohol with palmitic acid.*	skin cond. agent-emol.; fragrance ingr.
Ethylhexyl Pelargonate 59587-44-9	the ester of 2-ethylhexyl alcohol and Pelargonic Acid. *The ester obtained from the reaction of 2-ethylhexyl alcohol with pelargonic acid.*	skin cond. agent-emol.
Ethylhexyl Stearate 22047-49-0	the ester of 2-ethylhexyl alcohol and stearic acid. *The ester obtained from the reaction of 2-ethylhexyl alcohol with stearic acid.*	skin cond. agent-emol.
Erucyl Arachidate	the ester of erucyl alcohol and Arachidic Acid. *The ester obtained from the reaction of erucyl alcohol with arachidic acid.*	skin cond. agent-misc.
Erucyl Erucate 27640-89-7; 84605-12-9	the ester of erucyl alcohol and erucic acid. *The ester obtained from the reaction of erucyl alcohol with erucic acid.*	skin cond. agent-misc.
Erucyl Oleate 85617-81-8	the ester of erucyl alcohol and oleic acid that conforms to the formula. *The ester obtained from the reaction of erucyl alcohol with oleic acid.*	skin cond. agent-misc.
Heptyl Undecylenate 68141-27-5	the organic compound that conforms to the formula. *The ester obtained from the reaction of heptyl alcohol with 10-undecenoic acid.*	skin cond. agent-emol.
Heptylundecyl Hydroxystearate 74659-69-1	the organic compound that conforms to the formula. *The ester obtained from the reaction of 2-heptylundecyl alcohol with 12-hydroxystearate.*	skin cond. agent-emol.
Hexyldecyl Hexyldecanoate	the ester that conforms to the formula. *The ester obtained from the reaction of 2-hexyldecanol with 2-hexyldecanoic acid.*	skin cond. agent-emol.
Hexyldecyl Isostearate 69247-84-3	the ester of hexyldecyl alcohol and isostearic acid. *The mixture of esters obtained from the reaction of 2-hexyldecyl alcohol with branched-chain stearic acids.*	skin cond. agent-oc.
Hexyldecyl Laurate 34362-27-1; 227450-65-9	the ester of hexyldecanol and lauric acid. *The ester obtained from the reaction of 2-hexyldecanol with lauric acid.*	skin cond. agent-emol.; skin cond. agent-oc.
Hexyldecyl Oleate 94278-07-6	the ester of Hexyldecanol and oleic acid. *The ester obtained from the reaction of 2-hexyldecanol with oleic acid.*	skin cond. agent-oc.
Hexyldecyl Palmitate 69275-02-1	the ester of Hexyldecanol and palmitic acid that conforms to the formula. *The ester obtained from the reaction of 2-hexyldecanol with palmitic acid.*	skin cond. agent-oc.
Hexyldecyl Stearate 17618-45-0	the ester of Stearic Acid and Hexyldecanol. *The ester obtained from the reaction of 2-hexyldecanol with stearic acid.*	skin cond. agent-emol.; skin cond. agent-oc.
Hexyldodecyl/Octyldecyl Hydroxystearate	the product formed by the reaction of Hexyldodecanol and Octyldecanol with Hydroxystearic Acid. *The mixture of esters obtained from the reaction of a mixture of 2-hexyldodecanol and 2-octyldecanol with 12-hydroxystearic acid.*	skin cond. agent-emol.
Hexyl Isostearate 94247-25-3	the ester of hexyl alcohol and isostearic acid that conforms to the formula. *The mixture of esters obtained from the reaction of hexyl alcohol with branched-chain stearic acids.*	skin cond. agent-emol.
Hexyl Laurate 34316-64-8	the ester of hexyl alcohol and lauric acid. *The ester obtained from the reaction of hexyl alcohol with lauric acid.*	skin cond. agent-emol.
Hydrogenated Castor Oil Behenyl Esters	the hydrogenation product of the esters formed by the reaction of castor oil and behenyl alcohol. *The hydrogenation product of the mixture of esters obtained from the reaction of behenyl alcohol with castor oil.*	hair cond. agent; binder; emul. stab.
Hydrogenated Castor Oil Cetyl Esters	the hydrogenation product of the esters formed by the reaction of castor oil with cetyl alcohol. *The hydrogenation product of the mixture of esters obtained from the reaction of cetyl alcohol with castor oil*.	skin cond. agent-misc.; hair cond. agent; binder; emul. stab.
Hydrogenated Castor Oil Stearyl Esters	the hydrogenation product of the esters formed by the reaction of castor oil and stearyl alcohol. *The hydrogenation product of the mixture of esters obtained from the reaction of stearyl alcohol with castor oil*.	skin cond. agent-misc.; hair cond. agent; binder; emul. stab.
Hydrogenated Ethylhexyl Olivate	a mixture of esters produced by the reaction of ethylhexanol and Hydrogenated Olive Oil. *The mixture of esters obtained from the reaction of 2-ethylhexyl alcohol with hydrogenated olive oil.*	skin cond. agent-emol.
Hydrogenated Ethylhexyl Sesamate	the product of the transesterification of 2-ethylhexyl alcohol and sesame seed oil that has been hydrogenated. *The mixture of esters obtained from the reaction of 2-ethylhexyl alcohol with hydrogenated sesame seed oil.*	skin cond. agent-emol.; binder
Hydrogenated Isocetyl Olivate	the end-product of the controlled hydrogenation of the mixture of esters formed by the reaction of isocetyl alcohol with olive acid. *The hydrogenation product of the mixture of esters obtained from the reaction of branched-chain cetyl alcohols with the fatty acids derived from olive acid.*	skin cond. agent-misc.; binder; disp. agent; humectant
Hydrogenated Isopropyl Jojobate	the end-product of the controlled hydrogenation of Isopropyl Jojobate. *The hydrogenation product of the mixture of esters obtained from the reaction of iso-propyl alcohol with the fatty acids derived from Simmondsia Chinensis (Jojoba) Oil*.	skin cond. agent-oc.
Hydroxycetyl Isostearate	the ester of hydroxycetyl alcohol and isostearic acid. *The mixture of esters obtained from the reaction of cetyl glycol with branched-chain stearic acids.*	skin cond. agent-emol.
Hydroxyoctacosanyl Hydroxy-stearate 93840-71-2	the ester of hydroxyoctacosanyl alcohol and hydroxystearic acid. *The ester obtained from the reaction of 2-hydroxyoctacosanyl alcohol with 12-hydroxystearic acid.*	skin cond. agent-emol.; visc. incr. agent

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Ingredient/CAS No.	Definition[24] (italicized text generated by CIR)	Function[24]
Isoamyl Laurate 6309-51-9	the ester of isoamyl alcohol and lauric acid. *The ester obtained from the reaction of isoamyl alcohol with lauric acid.*	skin cond. agent-emol.; fragrance ingr.
Isobutyl Myristate 25263-97-2	the ester of isobutyl alcohol and myristic acid. *The ester obtained from the reaction of isobutyl alcohol with myristic acid.*	skin cond. agent-emol.
Isobutyl Palmitate 110-34-9	the ester of isobutyl alcohol and palmitic acid. *The ester obtained from the reaction of isobutyl alcohol with palmitic acid.*	skin cond. agent-emol.; fragrance ingr.
Isobutyl Pelargonate 30982-03-7	the ester of isobutyl alcohol and Pelargonic Acid. *The ester obtained from the reaction of isobutyl alcohol with nonanoic acid.*	skin cond. agent-emol.; fragrance ingr.
Isobutyl Stearate 646-13-9	the ester of isobutyl alcohol and stearic acid. *The ester obtained from the reaction of isobutyl alcohol with stearic acid*	skin cond. agent-emol.
Isobutyl Tallowate 68526-50-1	the ester of isobutyl alcohol and Tallow Acid. *The mixture of esters obtained from the reaction of isobutyl alcohol with the fatty acids derived from tallow acid.*	skin cond. agent-emol.
Isocetyl Behenate 94247-28-6	the ester of Isocetyl Alcohol and behenic acid. *The mixture of esters obtained from the reaction of branched-chain cetyl alcohols with behenic acid.*	skin cond. agent-oc.
Isocetyl Isodecanoate 129588-05-2	the mixture of esters obtained from the reaction of isocetyl alcohol with a branched, fatty acid, containing 10 carbons in the alkyl chain. *The mixture of esters obtained from the reaction of branched-chain cetyl alcohols with branched-chain decanoic acids.*	skin cond. agent-emol.
Isocetyl Isostearate 52006-45-8	the ester of isocetyl alcohol and isostearic acid. *The mixtures of esters obtained from the reaction of branched-chain cetyl alcohols with branched-chain stearic acids.*	skin cond. agent-emol.
Isocetyl Laurate 89527-28-6	the ester of isocetyl alcohol and lauric acid. *The mixture of esters obtained from the reaction of branched-chain cetyl alcohols with lauric acid.*	skin cond. agent-emol.
Isocetyl Myristate 83708-66-1	the ester of Isocetyl Alcohol and myristic acid. *The mixture of esters obtained from the reaction of branched-chain cetyl alcohols with myristic acid.*	skin cond. agent-oc.
Isocetyl Palmitate 127770-27-8	the ester of Isocetyl Alcohol and palmitic acid. *The mixture of esters obtained from the reaction of branched-chain cetyl alcohols with palmitic acid.*	skin cond. agent-emol.
Isocetyl Stearate 25339-09-7	the ester of isocetyl alcohol and stearic acid. *The mixture of esters obtained from the reaction of branched-chain cetyl alcohols with stearic acid.*	skin cond. agent-emol.
Isodecyl Cocoate	the ester of branched chain decyl alcohols and coconut acid. *The mixture of esters obtained from the reaction of branched-chain decyl alcohols with the fatty acids derived from coconut acid.*	skin cond. agent-emol.
Isodecyl Hydroxystearate 29383-27-5; 59231-36-6	the ester of branched chain decyl alcohols and 12-hydroxystearic acid. *The mixture of esters obtained from the reaction of branched-chain decyl alcohols with 12-hydroxystearic acid.*	skin cond. agent-emol.
Isodecyl Isononanoate 41395-89-5; 59231-35-5	the ester of branched chain decyl alcohols and a branched chain nonanoic acid. *The mixture of esters obtained from the reaction of branched-chain decyl alcohols with branched-chain nonanoic acids.*	skin cond. agent-emol.
Isodecyl Laurate 14779-93-2; 94247-10-6	the ester of branched chain decyl alcohols and lauric acid. *The mixture of esters obtained from the reaction of branched-chain decyl alcohols with lauric acid.*	skin cond. agent-emol.
Isodecyl Myristate 17670-91-6; 51473-24-6	the ester of branched chain decyl alcohols and myristic acid. *The mixture of esters obtained from the reaction of branched-chain decyl alcohols with myristic acid.*	skin cond. agent-emol.
Isodecyl Neopentanoate 60209-82-7	the ester of branched chain decyl alcohols and neopentanoic acid. *The mixture of esters obtained from the reaction of branched-chain decyl alcohols with neopentanoic acid.*	skin cond. agent-emol.
Isodecyl Oleate 59231-34-4	the ester of branched chain decyl alcohols and oleic acid. *The mixture of esters obtained from the reaction of branched-chain decyl alcohols with oleic acid.*	skin cond. agent-emol.
Isodecyl Palmitate 14779-95-4; 59231-33-3	the ester of branched chain decyl alcohols and palmitic acid. *The mixture of esters obtained from the reaction of branched-chain decyl alcohols with palmitic acid.*	skin cond. agent-emol.
Isodecyl Stearate 31565-38-5	the ester of branched decyl alcohols and stearic acid. *The mixture of esters obtained from the reaction of branched-chain decyl alcohols with stearic acid*.	skin cond. agent-emol.
Isohexyl Caprate	the ester of capric acid and a branched chain, 6-carbon alcohol. *The mixture of esters obtained from the reaction of branched-chain hexyl alcohols with capric acid.*	skin cond. agent-emol.
Isohexyl Laurate 59219-73-7	the ester of a branched chain hexyl alcohol and lauric acid. *The mixture of esters obtained from the reaction of branched-chain hexyl alcohols with lauric acid.*	skin cond. agent-emol.
Isohexyl Neopentanoate 131141-70-3; 150588-62-8	the ester of isohexyl alcohol and neopentanoic acid that conforms to the formula. *The mixture of esters obtained from the reaction of branched-chain hexyl alcohols with neopentanoic acid.*	skin cond. agent-emol.
Isohexyl Palmitate 55194-91-7; 59219-72-6	the ester of branched chain hexyl alcohols and palmitic acid. *The mixture of esters obtained from the reaction of branched-chain hexyl alcohols with palmitic acid.*	skin cond. agent-emol.
Isolauryl Behenate	the ester of branched chain dodecyl alcohols and behenic acid. *The mixture of esters obtained from the reaction of branched-chain lauryl alcohols with behenic acid.*	skin cond. agent-oc.
Isononyl Isononanoate 42131-25-9; 59219-71-5	the ester of branched chain nonyl alcohols with a branched chain nonanoic acid. *The mixture of esters obtained from the reaction of branched-chain nonyl alcohols with branched-chain nonanoic acids.*	skin cond. agent-emol.
Isooctyl Caprylate/Caprate	the ester of branched chain octyl alcohols with a mixture of caprylic and capric acids. *The mixture of esters obtained from the reaction of branched-chain octyl alcohols with a mixture of caprylic and capric acids.*	skin cond. agent-emol.; antioxidant
Isooctyl Tallate	the organic compound that conforms to the formula. *The mixture of esters obtained from the reaction of branched-chain octyl alcohols with the fatty acids derived from tall oil.*	skin cond. agent-emol.; plasticizer; solvent
Isopropyl Arachidate 26718-90-1	the ester of isopropyl alcohol and Arachidic Acid that conforms to the formula. *The ester obtained from the reaction of isopropyl alcohol with arachidic acid.*	skin cond. agent-emol.

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Ingredient/CAS No.	Definition[24] (italicized text generated by CIR)	Function[24]
Isopropyl Avocadate 90990-05-9	the ester of isopropyl alcohol and the fatty acids derived from avocado oil. *The mixture of esters obtained from the reaction of isopropyl alcohol with the fatty acids derived from avocado oil.*	skin cond. agent-emol.
Isopropyl Babassuate	the ester of isopropyl alcohol and the fatty acids derived from Orbignya Oleifera (Babassu) Oil. *The mixture of esters obtained from the reaction of isopropyl alcohol with the fatty acids derived from Orbignya Oleifera (Babassu) Oil.*	skin cond. agent-emol.; binder; disp. agent-non-surf; emul. stab.
Isopropyl Behenate 26718-95-6	the ester of isopropyl alcohol and Behenic Acid. *The ester obtained from the reaction of isopropyl alcohol with behenic acid.*	skin cond. agent-emol.
Isopropyl Hydroxystearate	the ester of isopropyl alcohol and 12-hydroxystearic acid. *The ester obtained from the reaction of isopropyl alcohol with 12-hydroxystearic acid.*	skin cond. agent-emol.
Isopropyl Isostearate 31478-84-9; 68171-33-5	the ester of isopropyl alcohol and isostearic acid. *The mixture of esters obtained from the reaction of isopropyl alcohol with branched-chain stearic acids.*	skin cond. agent-emol.; binder
Isopropyl Jojobate	the ester of isopropyl alcohol and the acids derived from Simmondsia Chinensis (Jojoba) Oil. *The mixture of esters obtained from the reaction of isopropyl alcohol with the fatty acids derived from Simmondsia Chinensis (Jojoba) Oil.*	skin cond. agent-emol.
Isopropyl Laurate 10233-13-3	the ester of isopropyl alcohol and lauric acid. *The ester obtained from the reaction of isopropyl alcohol with lauric acid.*	skin cond. agent-emol.; binder; fragrance ingr.
Isopropyl Linoleate 22882-95-7	the ester of isopropyl alcohol and linoleic acid. *The ester obtained from the reaction of isopropyl alcohol with linoleic acid.*	skin cond. agent-emol.
Isopropyl Myristate 110-27-0	the ester of isopropyl alcohol and myristic acid. *The ester obtained from the reaction of isopropyl alcohol with myristic acid.*	skin cond. agent-emol.; binder; fragrance ingr.
Isopropyl Oleate 112-11-8; 17364-07-7	the ester of isopropyl alcohol and oleic acid. *The ester obtained from the reaction of isopropyl alcohol with oleic acid.*	skin cond. agent-emol.; binder
Isopropyl Palmitate 142-91-6	the ester of isopropyl alcohol and palmitic acid. *The ester obtained from the reaction of isopropyl alcohol with myristic acid.*	skin cond. agent-emol.; binder; fragrance ingr.
Isopropyl Ricinoleate 71685-99-9	the ester of isopropyl alcohol and ricinoleic acid. *The ester obtained from the reaction of isopropyl alcohol with ricinoleic acid.*	skin cond. agent-emol.
Isopropyl Stearate 112-10-7	the ester of isopropyl alcohol and stearic acid. *The ester obtained from the reaction of isopropyl alcohol with stearic acid.*	skin cond. agent-emol.; binder
Isopropyl Tallowate	the ester of isopropyl alcohol and Tallow Acid. *The mixture of esters obtained from the reaction of isopropyl alcohol with the fatty acids derived from tallow acid.*	skin cond. agent-emol.; binder
Isostearyl Avocadate 90990-06-0	the ester of Isostearyl Alcohol and the acids derived from avocado oil. *The mixture of esters obtained from the reaction of branched-chain stearic alcohols with the fatty acids derived from avocado oil.*	skin cond. agent-emol.
Isostearyl Behenate 125804-16-2	the ester of Isostearyl Alcohol and Behenic Acid. *The mixture of esters obtained from the reaction of branched-chain stearic alcohols with behenic acid*.	skin cond. agent-oc.
Isostearyl Erucate 84605-10-7	the ester of Isostearyl Alcohol and erucic acid. *The mixture of esters obtained from the reaction of branched-chain stearyl alcohols with erucic acid.*	skin cond. agent-oc.
Isostearyl Hydroxystearate 162888-05-3; 338450-67-2	the ester of isostearyl alcohol and hydroxystearic acid. *The mixture of esters obtained from the reaction of branched-chain stearyl alcohols with 12-hydroxystearic acid.*	skin cond. agent-emol.
Isostearyl Isononanoate 90967-66-1; 163564-45-2	the ester of isostearyl alcohol and isononanoic acid. *The mixture of esters obtained from the reaction of branched-chain stearyl alcohols with branched-chain nonanoic acids.*	skin cond. agent-emol.
Isostearyl Isostearate 41669-30-1	the ester of Isostearyl Alcohol and Isostearic Acid. *The mixture of esters obtained from the reaction of branched-chain stearyl alcohols with branched-chain stearic acids.*	skin cond. agent-emol.; binder
Isostearyl Laurate	the ester of isostearyl alcohol and lauric acid. *The mixture of esters obtained from the reaction of branched-chain stearyl alcohols with lauric acid*	skin cond. agent-emol.
Isostearyl Linoleate 127358-80-9	the ester of isostearyl alcohol and linoleic acid. *The mixture of esters obtained from the reaction of branched-chain stearyl alcohols with linoleic acid.*	skin cond. agent-emol.
Isostearyl Myristate 72576-81-9	the ester of isostearyl alcohol and myristic acid. *The mixture of esters obtained from the reaction of branched-chain stearyl alcohols with myristic acid.*	skin cond. agent-emol.; binder
Isostearyl Neopentanoate 58958-60-4	the ester of isostearyl alcohol and neopentanoic acid. *The mixture of esters obtained from the reaction of branched-chain stearyl alcohols with neopentanoic acid*.	skin cond. agent-emol.; binder
Isostearyl Palmitate 69247-83-2; 72576-80-8	the ester of Isostearyl Alcohol and palmitic acid. *The mixture of esters obtained from the reaction of branched-chain stearyl alcohols with palmitic acid*.	skin cond. agent-emol.; binder
Isotridecyl Isononanoate 42131-27-1; 59231-37-7	the ester of isotridecyl alcohol and isononanoic acid. *The mixture of esters obtained from the reaction of branched-chain tridecyl alcohols with branched-chain nonanoic acids.*	skin cond. agent-emol.
Isotridecyl Laurate 94134-83-5	the ester of Isotridecyl Alcohol and lauric acid that conforms generally to the formula. *The mixture of esters obtained from the reaction of branched-chain tridecyl alcohols with lauric acid.*	skin cond. agent-oc.; hair cond. agent
Isotridecyl Myristate 96518-24-0	The ester of myristic acid and isotridecyl alcohol. *The mixture of esters obtained from the reaction of branched-chain tridecyl alcohols with myristic acid*.	skin cond. agent-oc.; hair cond. agent
Isotridecyl Stearate 31565-37-4	the monoester of isotridecyl alcohol and stearic acid that conforms to the formula. *The mixture of esters obtained from the reaction of branched-chain tridecyl alcohols with stearic acid.*	skin cond. agent-emol.
Lauryl Behenate 42233-07-8	the ester of lauryl alcohol and behenic acid. *The ester obtained from the reaction of lauryl alcohol with behenic acid.*	skin cond. agent-oc.
Lauryl Cocoate	the ester of lauryl alcohol and the fatty acids derived from coconut oil. *The mixture of esters obtained from the reaction of lauryl alcohol with the fatty acids derived from coconut oil.*	skin cond. agent-emol.; skin cond. agent-oc.

Table 5. Definitions and functions

Ingredient/CAS No.	Definition[24] (italicized text generated by CIR)	Function[24]
Lauryl Isostearate 93803-85-1	the ester of lauryl alcohol and Isostearic Acid. *The mixture of esters obtained from the reaction of lauryl alcohol with branched-chain stearic acids*.	skin cond. agent-emol.
Lauryl Laurate 13945-76-1	the ester of Lauryl Alcohol and Lauric Acid. *The ester obtained from the reaction of lauryl alcohol with lauric acid.*	skin cond. agent-misc.; binder; emul. stab.; hair cond. agent; opacifying agent
Lauryl Myristate 2040-64-4	the ester of lauryl alcohol and myristic acid. *The ester obtained from the reaction of lauryl alcohol with myristic acid.*	skin cond. agent-oc.; hair cond. agent
Lauryl Oleate 36078-10-1	ester of lauryl alcohol and oleic acid that conforms to the formula. *The ester obtained from the reaction of lauryl alcohol with oleic acid.*	skin cond. agent-oc.
Lauryl Palmitate 42232-29-1	the ester of lauryl alcohol and palmitic acid. *The ester obtained from the reaction of lauryl alcohol with palmitic acid.*	skin cond. agent-oc.
Lauryl Stearate 5303-25-3	the ester of lauryl alcohol and stearic acid. *The ester obtained from the reaction of lauryl alcohol with stearic acid.*	skin cond. agent-oc.
Lignoceryl Erucate	the ester of lignoceryl alcohol and erucic acid. *The ester obtained from the reaction of lignoceryl alcohol with erucic acid.*	skin cond. agent-emol.
Myristyl Isostearate 94247-26-4	the ester of myristyl alcohol and isostearic acid. *The mixture of esters obtained from the reaction of myristyl alcohol with branched-chain stearic acids.*	skin cond. agent-emol.
Myristyl Laurate 22412-97-1	the ester of myristyl alcohol and lauric acid. *The ester obtained from the reaction of myristyl alcohol with lauric acid.*	surf-emulsifying agent
Myristyl Myristate 3234-85-3	the ester of myristyl alcohol and myristic acid. *The ester obtained from the reaction of myristyl alcohol with myristic acid*	skin cond. agent-oc.
Myristyl Neopentanoate 144610-93-5	the ester of myristyl alcohol and neopentanoic acid. *The ester obtained from the reaction of myristyl alcohol with neopentanoic acid.*	skin cond. agent-emol.
Myristyl Stearate 17661-50-6	the ester of myristyl alcohol and stearic acid. *The ester obtained from the reaction of myristyl alcohol and stearic acid.*	skin cond. agent-oc.
Octyldecyl Oleate	the ester of octyldecanol and oleic acid. *The ester obtained from the reaction of 2-octyldecanol with oleic acid.*	skin cond. agent-emol.
Octyldodecyl Avocadoate	the ester of Octyldodecanol and the fatty acids derived from avocado oil. *The mixture of esters obtained from the reaction of 2-octyldodecanol with the fatty acids derived from avocado oil.*	skin cond. agent-emol.
Octyldodecyl Beeswax	the ester of Octyldodecanol and Beeswax Acid. *The mixture of esters obtained from the reaction of 2-octyldodecanol with a mixture of straight-chain fatty acids, containing 24 to 36 carbons in alkyl chain length (beeswax acid).*	skin cond. agent-emol.
Octyldodecyl Behenate 125804-08-2	the ester of Octyldodecanol and behenic acid that conforms to the formula. *The ester obtained from the reaction of 2-octyldodecanol with behenic acid.*	skin cond. agent-oc.
Octyldodecyl Cocoate	the ester of octyldodecanol and coconut acid. *The mixture of esters obtained from the reaction of 2-octyldodecanol and the fatty-acids derived from coconut acid.*	skin cond. agent-emol.
Octyldodecyl Erucate 88103-59-7	the ester of octyldodecanol and erucic acid. *The ester obtained from the reaction of 2-octyldodecanol with erucic acid.*	skin cond. agent-oc.
Octyldodecyl Hydroxystearate 308122-33-0	the ester of Octyldodecanol and 12-hydroxystearic acid. *The ester obtained from the reaction of 2-octyldodecanol and 12-hydroxystearic acid*.	skin cond. agent-oc.
Octyldodecyl Isostearate 93803-87-3	the ester of Octyldodecanol and isostearic acid. *The mixture of esters obtained from the reaction of 2-octyldodecanol with isostearic acid.*	skin cond. agent-oc.
Octyldodecyl Meadowfoamate	the ester of Octyldodecanol and the fatty acids derived from Limnanthes Alba (Meadowfoam) Seed Oil. *The mixture of esters obtained from the reaction of 2-octyldodecanol with the fatty acids derived from Limnanthes Alba (Meadowfoam) Seed Oil.*	skin cond. agent-oc.
Octyldodecyl Myristate 22766-83-2; 83826-43-1	the ester of octyldodecanol and myristic acid. *The ester obtained from the reaction of 2-octyldodecanol with myristic acid.*	skin cond. agent-oc.
Octyldodecyl Neodecanoate 1004272-41-6	the ester of Octyldodecanol and neodecanoic acid. *The ester obtained from the reaction of 2-octyldodecanol with neodecanoic acid.*	skin cond. agent-emol.
Octyldodecyl Neopentanoate 158567-66-9	the ester of Octyldodecanol and neopentanoic acid. *The ester obtained from the reaction of 2-octyldodecanol with neopentanoic acid.*	skin cond. agent-emol.
Octyldodecyl Octyldodecanoate	the ester of Octyldecanol and octyldodecanoic acid. *The ester obtained from the reaction of 2-octyldecanol with 2-octyldodecanoic acid.*	skin cond. agent-oc.
Octyldodecyl Oleate 22801-45-2	the ester of Octyldodecanol and oleic acid. *The ester obtained from the reaction of 2-octyldodecanol with oleic acid.*	skin cond. agent-oc.
Octyldodecyl Olivate 22801-45-2	the ester of Octyldodecanol and the fatty acids derived from Olea Europaea (Olive) Oil. *The ester obtained from the reaction of 2-octyldodecanol with the fatty acids derived from Olea Europaea (Olive) Oil*.	skin cond. agent-emol.; skin cond. agent-oc.; binder; film former; hair cond. agent; slip modifier
Octyldodecyl Ricinoleate 79490-62-3; 125093-27-8	the ester of octyldodecanol and ricinoleic acid. *The ester obtained from the reaction of 2-octyldodecanol with ricinoleic acid.*	hair cond. agent; shampoo
Octyldodecyl Safflowerate	the ester of Octyldodecanol and the fatty acids derived from Carthamus Tinctorius (Safflower) Oil. *The ester obtained from the reaction of 2-octyldodecanol with the fatty acids derived from Carthamus Tinctorius (Safflower) Oil.*	skin cond. agent-emol.
Octyldodecyl Stearate 22766-82-1	the ester of octyldodecanol and stearic acid. *The ester obtained from the reaction of 2-octyldodecanol with stearic acid.*	skin cond. agent-oc.
Oleyl Arachidate 22393-96-0; 156952-79-3	the ester of oleyl alcohol and Arachidic Acid. *The ester obtained from the reaction of oleyl alcohol with arachidic acid.*	skin cond. agent-oc.
Oleyl Erucate 17673-56-2; 143485-69-2	the ester of Oleyl Alcohol and erucic acid. *The ester obtained from the reaction of oleyl alcohol with erucic acid.*	skin cond. agent-oc.
Oleyl Linoleate 17673-59-5	the ester of Oleyl Alcohol and Linoleic Acid. *The ester obtained from the reaction of oleyl alcohol with linoleic acid.*	skin cond. agent-oc.; hair cond. agent

Table 5. Definitions and functions

Ingredient/CAS No.	Definition[24] (italicized text generated by CIR)	Function[24]
Oleyl Myristate 22393-93-7	the ester of oleyl alcohol and myristic acid. *The ester obtained from the reaction of oleyl alcohol with myristic acid.*	skin cond. agent-oc.; hair cond. agent
Oleyl Oleate 3687-45-4; 17363-94-9	the ester of Oleyl Alcohol and oleic acid. *The ester obtained from the reaction of oleyl alcohol with oleic acid.*	skin cond. agent-emol.; skin cond. agent-emol.
Oleyl Stearate 33057-39-5; 17673-50-6	the ester of oleyl alcohol and stearic acid. *The ester obtained from the reaction of oleyl alcohol with stearic acid.*	skin cond. agent-oc.; hair cond. agent
Propylheptyl Caprylate 868839-23-0	the organic compound that conforms to the formula. *The ester obtained from the reaction of 2-propylheptanol with caprylic acid.*	skin cond. agent-emol.
Stearyl Beeswax 42233-11-4	the ester of Stearyl Alcohol and Beeswax Acid. *The mixture of esters obtained from the reaction of stearyl alcohol with a mixture of straight-chain fatty acids, containing 24 to 36 carbons in alkyl chain length (beeswax acid).*	skin cond. agent-oc.
Stearyl Behenate 24271-12-3	the ester of stearyl alcohol and behenic acid. *The ester obtained from the reaction of stearyl alcohol with behenic acid.*	skin cond. agent-oc.
Stearyl Caprylate 18312-31-7	the ester of stearyl alcohol and caprylic acid. *The ester obtained from the reaction of stearyl alcohol with caprylic acid.*	skin cond. agent-oc.
Stearyl Erucate 86601-84-5; 96810-34-3	the ester of stearyl alcohol and erucic acid. *The ester obtained from the reaction of stearyl alcohol with erucic acid.*	visc. incr. agent-nonaq.
Stearyl Heptanoate 66009-41-4	the ester of stearyl alcohol and heptanoic acid. *The ester obtained from the reaction of stearyl alcohol with heptanoic acid.*	skin cond. agent-oc.
Stearyl Linoleate 17673-53-9	the ester of stearyl alcohol and linoleic acid that conforms to the formula. *The ester obtained from the reaction of stearyl alcohol with linoleic acid*.	skin cond. agent-oc.; visc. incr. agent-nonaq.
Stearyl Olivate	the ester of stearyl alcohol and the fatty acids derived from Olea Europaea (Olive) Oil. *The ester obtained from the reaction of stearyl alcohol with the fatty acids derived from Olea Europaea (Olive) Oil*.	skin cond. agent-emol.; surf-emulsifying agent
Stearyl Palmitate 2598-99-4	the ester of stearyl alcohol and palmitic acid. *The ester obtained from the reaction of stearyl alcohol with palmitic acid.*	skin cond. agent-misc.; hair cond. agent; binder; emul. stab; humectant; film former; opacifying agent
Stearyl Stearate 2778-96-3	the ester of stearyl alcohol and stearic acid. *The ester obtained from the reaction of stearyl alcohol with stearic acid.*	skin cond. agent-oc.; visc. incr. agent-nonaq.
Tetradecyleicosyl Stearate	the ester of Myristyleicosanol and stearic acid. *The ester obtained from the reaction of myristyleicosanol with stearic acid.*	skin cond. agent-oc.
Tetradecyloctadecyl Behenate	the ester of Tetradecyloctadecanol and Behenic Acid. *The ester obtained from the reaction of tetradecyloctadecanol with behenic acid.*	skin cond. agent-oc.; binder; emul. stab; film former; opacifying agent
Tetradecyloctadecyl Hexyldecanoate 93982-00-4	the organic compound that conforms to the formula. *The ester obtained from the reaction of 2-tetradecyloctyldecanol with 2-hexyldecanoic acid.*	skin cond. agent-emol.
Tetradecyloctadecyl Myristate	the ester of tetradecyloctadecanol and myristic acid. *The ester obtained from the reaction of 2-tetradecyloctyldecanol with myristic acid.*	skin cond. agent-oc.; binder; emul. stab; film former; opacifying agent
Tetradecyloctadecyl Stearate	the ester of Tetradecyloctadecanol and stearic acid. *The ester obtained from the reaction of 2-tetradecyloctadecanol with stearic acid.*	skin cond. agent-oc.; binder; emul. stab; film former; opacifying agent
Tetradecylpropionates	an isomeric mixture of esters consisting chiefly of 2-tetradecylproprionate, 3-tetradecylproprionate, and 4-tetradecylproprionate. *The mixture of esters obtained from the reaction of a mixture of 2-, 3-, and 4-tetradecanols with propionic acid.*	skin cond. agent-emol.; solvent
Tridecyl Behenate 42233-08-9	the ester of Tridecyl Alcohol and Behenic Acid. *The ester obtained from the reaction of tridecyl alcohol with behenic acid.*	skin cond. agent-oc.
Tridecyl Cocoate	the ester of tridecyl alcohol and coconut acid. *The mixture of esters obtained from the reaction of tridecyl alcohol with the fatty acids derived from coconut acid*.	skin cond. agent-oc.
Tridecyl Erucate 131154-74-0; 221048-36-8	the ester of Tridecyl Alcohol and erucic acid. *The ester obtained from the reaction of tridecyl alcohol with erucic acid.*	skin cond. agent-oc.
Tridecyl Isononanoate 125804-18-4	the ester of Tridecyl Alcohol and isononanoic acid that conforms to the formula. *The ester of tridecyl alcohol and branched-chain nonanoic acids*.	skin cond. agent-emol.
Tridecyl Laurate 36665-67-5	the ester of tridecyl alcohol and lauric acid that conforms to the formula. *The ester obtained from the reaction of tridecyl alcohol with lauric acid*.	skin cond. agent-oc.
Tridecyl Myristate 36617-27-3	the ester of tridecyl alcohol and myristic acid. *The ester obtained from the reaction of tridecyl alcohol with myristic acid.*	skin cond. agent-oc.
Tridecyl Neopentanoate 106436-39-9; 105859-93-6	the ester of Tridecyl Alcohol and neopentanoic acid. *The ester obtained from the reaction of tridecyl alcohol with neopentanoic acid.*	skin cond. agent-emol.
Tridecyl Stearate 31556-45-3	the ester of Tridecyl Alcohol and stearic acid. *The ester obtained from the reaction of tridecyl alcohol with stearic acid.*	skin cond. agent-emol.

Abbreviations: cond. – conditioning; disp. – dispersing; emol. – emollient; emul. – emulsion; incr. – increasing; ingr. – ingredient; misc. – miscellaneous; nonaq. – non-aqueous; nonsurf – non-surfactant; oc. – occlusive; solub. – solubilizing; stab. – stabilizer; surf. – surfactant; visc. – viscosity

Table 6. Methods of Manufacture

Ingredient	Method of Manufacture	Reference
Arachidyl Propionate	manufactured as a mixture of the esters of the $C_{18} - C_{28}$ fatty alcohols, of which C_{20} fatty alcohol ester is the major constituent	13
Butyl Oleate	reaction of butanol and oleic acid in the presence of dihydrogen phosphate	68
	prepared from *n*-butanol and oleic acid by heating, with sulfuric acid as a catalyst	69,70
	esterification of oleic acid with butyl alcohol in *n*-hexane in the presence of the macroporous sulfonic resin K2411	71
	synthesized with *Candida antarctica* lipase catalyst or using a sodium alcoholate catalyst	22
	esterification of oleic acid with butanol in the presence of *p*-toluene sulfonic acid	72
	lipase-catalyzed oleic acid esterification by *n*-butyl alcohol in almost non-aqueous media without an organic solvent	
Butyl Myristate	derived from the esterification of myristic acid and butyl alcohol in the presence of an acid catalyst	14
Butyl Stearate	the esterification of stearic acid with butyl alcohol; the reaction products are refined either by catalyst neutralization, vacuum distillation, or various decolorization-deodorization techniques to remove traces of alcohol	11
Cetyl Behenate	esterification of behenic acid with cetyl alcohol using *n*-butyl benzene as the solvent and tetra *n*-butyl titanate as the catalyst	74
Cetyl Oleate	cetyl alcohol and oleic acid were dissolved in benzene and heated, using sulfuric acid as a catalyst; the mixture was then washed, the benzene filtered and removed by vacuum distillation, and the ester separated twice by distillation	35
	esterification of oleic acid with cetyl alcohol in *n*-hexane in the presence of *p*-toluene sulfonic acid	71
	lipase-catalyzed oleic acid esterification by cetyl alcohol in almost non-aqueous media without an organic solvent	73
Cetyl Stearate	the esterification of stearic acid with cetyl alcohol; the reaction products are refined either by catalyst neutralization, vacuum distillation, or various decolorization-deodorization techniques to remove traces of alcohol	11
Ethylhexyl Laurate	co-produced by the lipase-catalyzed acylation of racemic alcohol and vinyl laurate in the production of (R)-2-ethylhexanol	75
Ethylhexyl Oleate	synthesized with *Candida antarctica* lipase catalyst or using a sodium alcoholate catalyst	22
Ethylhexyl Stearate	the esterification of stearic acid with octyl alcohol; the reaction products are refined either by catalyst neutralization, vacuum distillation, or various decolorization-deodorization techniques to remove traces of alcohol	11
Isobutyl Stearate	the esterification of stearic acid with isobutyl alcohol; the reaction products are refined either by catalyst neutralization, vacuum distillation, or various decolorization-deodorization techniques to remove traces of alcohol	11
Isocetyl Myristate	the esterification of isocetyl alcohol and myristic acid	16
Isocetyl Stearate	the esterification of stearic acid with isocetyl alcohol; the reaction products are refined either by catalyst neutralization, vacuum distillation, or various decolorization-deodorization techniques to remove traces of alcohol	11
	can be made by heating with or without acid catalyst	
Isopropyl Arachidate	arachidic acid was treated with isopropyl alcohol in large molar excess, p-toluene sulfonic acid was the catalyst	76
Isopropyl Laurate	lauric acid was treated with isopropyl alcohol in large molar excess, p-toluene sulfonic acid was the catalyst	76
Isopropyl Myristate	commercially produced by distillation, which is preceded by the esterification of myristic acid and isopropanol, in the presence of an acid catalyst	10
Isopropyl Oleate	esterification of oleic acid with isopropyl alcohol in *n*-hexane in the presence of K2411	71
	synthesized with *Candida antarctica* lipase catalyst or using a sodium alcoholate catalyst	22
Isopropyl Stearate	the esterification of stearic acid with isopropyl alcohol; the reaction products are refined either by catalyst neutralization, vacuum distillation, or various decolorization-deodorization techniques to remove traces of alcohol	11
Isostearyl Neopentanoate	prepared by esterifying isostearyl alcohol with neopentanoic acid in the presence of a catalyst	12
Lauryl Behenate	esterification of behenic acid with lauryl alcohol using *n*-butyl benzene as the solvent and tetra *n*-butyl titanate as the catalyst	74
Lauryl Oleate	esterification of oleic acid with lauryl alcohol in *n*-hexane in the presence of *p*-toluene sulfonic acid	71
	synthesized with *Candida antarctica* lipase catalyst or using a sodium alcoholate catalyst	
Lauryl Palmitate	lipase-catalyzed esterification of palmitic acid and lauryl alcohol using Novozym 435 as the biocatalyst	77
Myristyl Laurate	the fatty acid chloride was reacted with myristic acid in the presence of pyridine, using diethyl ether as the solvent	78
Myristyl Myristate	produced by the esterification of myristic acid and myristyl alcohol in the presence of an acid catalyst	10
Myristyl Stearate	the esterification of stearic acid with myristyl alcohol; the reaction products are refined either by catalyst neutralization, vacuum distillation, or various decolorization-deodorization techniques to remove traces of alcohol	11
Octyldodecyl Myristate	the esterification of myristic acid with 2-octyl dodecanol, manufactured from vegetable sources	16
Oleyl Arachidate	the fatty acid chloride was reacted with oleic acid in the presence of pyridine, using diethyl ether as the solvent	78
Oleyl Oleate	the fatty acid chloride was reacted with oleic acid in the presence of pyridine, using diethyl ether as the solvent	78
	lipase-catalyzed oleic acid esterification by oleyl alcohol in almost non-aqueous media without an organic solvent	73
	synthesized with *Candida antarctica* lipase catalyst or using a sodium alcoholate catalyst	22
Oleyl Stearate	the fatty acid chloride was reacted with oleic acid in the presence of pyridine, using diethyl ether as the solvent	78

Table 7. Chemical and physical properties

Property	Description	Reference
Arachidyl Behenate		
molecular weight	621.12	79
boiling point	648.7°C (760 Torr) (calculated)	79
density	0.856 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	20.146 (25°C) (calculated)	79
Arachidyl Erucate		
molecular weight	619.10	79
boiling point	608.3°C (760 Torr) (calculated)	79
density	0.898 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	16.353 (25°C) (calculated)	79
Arachidyl Propionate		
characteristics	soft, waxy, amber-colored solid with a slight characteristic odor	13
melting point	36-38°C	13
boiling point	224°C	13
specific gravity	0.83	13
solubility	soluble in mineral oil	13
	insoluble in water	
Batyl Stearate		
molecular weight	611.03	79
boiling point	656.9°C (760 Torr) (calculated)	79
density	0.856 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	20.146 (25°C) (calculated)	79
pKa	14.08 (most acidic temperature: 25°C) (calculated)	79
Behenyl Behenate		
molecular weight	649.18	80
Behenyl Erucate		
molecular weight	647.15	79
boiling point	669.1°C (760 Torr) (calculated)	79
density	0.860 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	20.755 (25°C) (calculated)	79
Butyl Myristate		
form	colorless oily liquid	14
boiling point	167-197°C (5 mm Hg)	14
specific gravity	0.850 – 0.858 (25°C)	14
solubility	soluble in acetone, castor oil, chloroform, methanol, mineral oil, and toluene	14
	insoluble in water	
Butyl Oleate		
appearance and form	mobile, yellow, oily liquid	
molecular weight	338.57	68
melting point	-31.7°C	22
	-35.5°C	72
boiling point	235-45 °C	68
density	0.870 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	9.547 (25°C) (calculated)	79
Butyl Stearate		
characteristics	stable, colorless, oily liquid	11
molecular weight	340.57	11
melting point	16-20.5°C	11
boiling point	212-216°C	11
specific gravity	0.851-0.861 (20°/20°C)	11
refractive index	1.441 (25°C)	11
saponification value	146-177	11
solubility	soluble in acetone, chloroform, ether, alcohol, ketones, ethyl acetate, aromatic and aliphatic hydrocarbons, fats, waxes, mineral oils, and many plasticizers	11
	insoluble in water	
Caprylyl Butyrate		
molecular weight	200.32	79,80
melting point	-55.6°C	81
boiling point	244.1°C	81
water solubility	5.81 mg/l (25°C) (estimated)	81
density	0.870 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	4.861 (25°C) (calculated)	79
Caprylyl Caprylate		
molecular weight	256.42	79,80
melting point	-18.1°C	81
boiling point	306.8°C	81
water solubility	0.112 mg/l (25°C) (estimated)	81
density	0.865 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	6.899 (25°C) (calculated)	79

Table 7. Chemical and physical properties

Property	Description	Reference
Cetearyl Isononanoate		
form	yellowish liquid	19
melting point	<15°C	19
refractive index	1.445 – 1.450	19
density	0.854 – 8.858 g/ml	19
saponification value	140-146	19
solubility	insoluble in water	19
Cetyl Behenate		
molecular weight	565.01	79
melting point	65°C	74
boiling point	569.4°C (760 Torr) (calculated)	79
density	0.857 g/cm^3 (20°C; 760 Torr) (calculated)	79
specific gravity	0.8178 – 0.804 (70 - 100°C, respectively)	74
refractive index	1.441 – 1.433 (70 - 90°C, respectively)	74
log P	18.108 (25°C) (calculated)	79
Cetyl Caprylate		
form	liquid	41
molecular weight	368.64	79,80
boiling point	414.2°C (760 Torr) (calculated)	79
density	0.860 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	10.975 (25°C) (calculated)	79
Cetyl Esters		
characteristics	white to off-white, somewhat translucent solid with a crystalline structure and a faint odor	82
melting range	43-47°C	82
specific gravity	0.820-0.840 (50°C)	82
saponification value	109 - 120	82
solubility	soluble in boiling alcohol, ether, chloroform, and fixed oils insoluble in water and cold alcohol	82
composition	mixture consisting of esters of primarily saturated fatty alcohols (C_{14} to C_{18}) and saturated fatty acids (C_{14} to C_{18})	82
Cetyl Isononanoate		
molecular weight	382.66	19
log P	0.28 (calculated)	19
Cetyl Laurate		
molecular weight	424.74	79
melting point	40-41°C	83
boiling point	462.2°C (760 Torr) (calculated)	79
density	0.860 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	113.013 (25°C) (calculated)	79
Cetyl Myristoleate		
molecular weight	450.78	79
boiling point	519.6°C (calculated)	79
log P	14.005 (25°C) (calculated)	79
Cetyl Oleate		
molecular weight	506.89	80
melting point	25.5°C	84
saponification value	110.7	35
Cetyl Palmitate		
molecular weight	481	9
characteristics	white, crystalline, wax-like substance	9
melting point	46 - 54°C	9
specific gravity	0.832 (25°C)	9
refractive index	1.4398 (n_D70)	9
solubility	soluble in alcohol and ether insoluble in water	9
C32-36 Isoalkyl Stearate		
molecular weight	761.38	80
Decyl Cocoate		
characteristics	almost odorless light yellow liquid	17
specific gravity	0.85 g/cm^3 (25°C)	17
saponification value	155 -* 170	17
Decyl Laurate		
molecular weight	340.58	80
boiling point	388.9°C (760 Torr) (calculated)	79
log P	9.956 (25°C) (calculated)	79
Decyl Oleate		
characteristics	light yellow liquid	23
molecular weight	422	23
specific gravity	0.855 – 0.865	23
saponification value	103-142	23
solubility	soluble in alcohol insoluble in water	23

Table 7. Chemical and physical properties

Property	Description	Reference
Decyl Palmitate		
molecular weight	396.69	79,80
melting point	30°C	85
boiling point	438.7°C (760 Torr) (calculated)	79
density	0.860 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	11.994 (25°C) (calculated)	79
Ethylhexyl Hydroxystearate		
characteristics	clear to slightly opalescent, yellow, oily liquid with a slight fatty odor	82
boiling point	490.6°C (760 Torr) (calculated)	79
specific gravity	0.889-0.895 (25°/25°C)	82
saponification value	140-160	82
solubility	soluble in ethyl alcohol and corn oil insoluble in water and propylene glycol	82
log P	9.776 (25°C) (calculated)	79
Ethylhexyl Isononanoate		
molecular weight	270.45	19
log P	5.91 (calculated)	19
Ethylhexyl Isopalmitate		
form	liquid	41
Ethylhexyl Laurate		
molecular weight	312.53	79,80
melting point	-30°C	45
boiling point	>250°C (1013 hPa) 124-126°C (0.1 mm Hg)	45 75
water solubility	1 mg/l (20°C)	45
density	0.86 g/cm^3 (20°C)	45
log P	8.781 (25°C) (calculated)	79
Ethylhexyl Oleate		
molecular weight	394.67	79
melting point	-2.9°C	22
boiling point	465.8°C (760 Torr) (calculated)	79
density	0.867 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	11.429 (25°C) (calculated)	79
Ethylhexyl Palmitate		
molecular weight	388	9
characteristics	clear, colorless, practically odorless liquid	9
specific gravity	0.850 – 0.865 (25°C)	9
refractive index	1.445 – 1.4465 (25°C)	9
solubility	soluble in acetone, castor oil, corn oil, chloroform, ethanol, and mineral oil insoluble in water, glycerin, and propylene glycol	9
Ethylhexyl Pelargonate		
molecular weight	270.45	19
density	0.864 ± 0.06 g/cm^3 (20°C)	19
log P	7.432 (calculated)	19
Ethylhexyl Stearate		
molecular weight	396	11
Erucyl Erucate		
molecular weight	645.14	79
boiling point	668.1°C (760 Torr) (calculated)	79
density	0.865 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	20.346 (25°C) (calculated)	79
Erucyl Oleate		
molecular weight	589.03	79
boiling point	631.3	79
density	0.866 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	18.308 (25°C) (calculated)	79
Heptyl Undecylenate		
molecular weight	282.46	79,80
boiling point	351.0°C (760 Torr) (calculated)	79
density	0.871 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	7.510 (25°C) (calculated)	79
Heptylundecyl Hydroxystearate		
molecular weight	552.96	79
boiling point	607.3°C (760 Torr) (calculated)	79
density	0.885 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	14.870 (25°C) (calculated)	79
pKa	15.40 (most acidic temp: 25°C)	79
Hexyldecyl Laurate		
molecular weight	424.74	80
Hexyldecyl Oleate		
molecular weight	506.89	79,80
boiling point	563.6°C (760 Torr) (calculated)	79
density	0.863 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	15.505 (25°C) (calculated)	79

Table 7. Chemical and physical properties

Property	Description	Reference
Hexyldecyl Palmitate		
molecular weight	480.85	80
Hexyl Laurate		
molecular weight	284.48	79,80
melting point	-3.4°C	86
boiling point	130°C	86
density	0.864 g/cm^3 (20°C; 760 Torr) (calculated)	79
refractive index	1.4382	86
log P	7.918 (25°C) (calculated)	79
Hydroxyoctacosanyl Hydroxystearate		
molecular weight	709.22	79,80
boiling point	311.8°C (760 Torr) (calculated)	79
density	0.864 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	7.253 (25°C) (calculated)	79
Isoamyl Laurate		
molecular weight	270.45	79,80
boiling point	631.3	79
density	0.866 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	18.308 (25°C) (calculated)	79
Isobutyl Palmitate		
molecular weight	312.53	79,80
boiling point	354.6°C (760 Torr) (calculated)	79
density	0.862 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	8.781 (25°C) (calculated)	79
Isobutyl Pelargonate		
molecular weight	214.34	19
density	0.867 ± 0.06 g/cm^3 (20°C)	19
log P	5.307 (calculated)	19
Isobutyl Stearate		
characteristics	a paraffinlike crystal substance a low temperature; a liquid at room temperature	11
molecular weight	340.57	11
melting point	20°C	11
saponification value	170-180	11
Isocetyl Myristate		
characteristics	oily liquid with practically no odor	16
density	0.862	16
solubility	soluble in most organic solvents insoluble in water	16
Isocetyl Isostearate		
form	liquid	41
molecular weight	508.9	80
Isocetyl Palmitate		
form	liquid	41
Isocetyl Stearate		
characteristics	an oily, colorless or yellow liquid with practically no odor	11
molecular weight	508	11
specific gravity	0.8520-00.858 (25°/25°C)	11
refractive index	1.451-1.453 (25°C)	11
saponification value	110-118	11
solubility	soluble in ethanol, isopropanol, mineral oil, castor oil, acetone, and ethyl acetate insoluble in water, glycerin, and propylene glycol	11
Isodecyl Isononanoate		
molecular weight	298.5	19
refractive index	1.437 – 1.439 (25°C)	19
specific gravity	0.852 – 0.858 (25°/25°C)	19
saponification value	175 – 192	19
log P	6.68 (calculated)	19
Isodecyl Laurate		
form	colorless or pale yellow liquid	46
molecular weight	340.58	79
boiling point	374.2°C (760 Torr) (calculated)	79
density	0.860 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	9.644 (25°C) (calculated)	79
Isodecyl Neopentanoate		
molecular weight	242.40	80
Isodecyl Oleate		
molecular weight	422	23
saponification value	130-145	23
Isodecyl Palmitate		
molecular weight	396.69	79,80
boiling point	425.2°C (760 Torr) (calculated)	79
density	0.858 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	11.682 (25°C) (calculated)	79
Isodecyl Stearate		
molecular weight	424.74	80

Table 7. Chemical and physical properties

Property	Description	Reference
Isohexyl Caprate		
molecular weight	256.42	79
boiling point	296.8°C (760 Torr) (calculated)	79
density	0.864 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	6.743 (25°C) (calculated)	79
Isohexyl Laurate		
characteristics	pale yellow liquid with a coconut-like odor	82
molecular weight	284.48	79
boiling point	326.5°C (760 Torr) (calculated)	79
refractive index	1.439 - 1.442 (20°C)	82
specific gravity	0.843 -0.853 (25°/25°C)	82
saponification value	130 - 145	82
solubility	soluble in most organic solvents insoluble in water	82
free fatty acid content	0.1% (max.) (as lauric acid)	82
log P	7.762 (25°C) (calculated)	79
Isohexyl Neopentanoate		
molecular weight	186.29	79
boiling point	193.2°C (760 Torr) (calculated)	79
density	0.870 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	3.941 (25°C) (calculated)	79
Isohexyl Palmitate		
characteristics	light yellow liquid with a fatty-type odor	82
molecular weight	340.58	79
boiling point	381.5°C (760 Torr) (calculated)	79
refractive index	1.4433 - 1.4443 (20°C)	82
specific gravity	0.850 -0.860 (25°/25°C)	82
saponification value	165-171	82
solubility	soluble in alcohol and mineral oil insoluble in water and lower glycols and glycerin	82
log P	9.800 (25°C) (calculated)	79
Isononyl Isononanoate		
molecular weight	284.48	19
refractive index	1.430 – 1.436 (25°C)	19
specific gravity	0.849 – 0.855 (25°/25°C)	19
saponification value	192 - 202	19
log P	6.27 (calculated)	19
Isopropyl Arachidate		
form	white crystal	76
molecular weight	354.61	79
melting point	53-55°C	76
boiling point	394.4°C (760 Torr) (calculated)	79
density	0.860 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	10.310 (25°C) (calculated)	79
Isopropyl Behenate		
molecular weight	382.66	79
boiling point	419.6°C (760 Torr) (calculated)	79
density	0.859 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	11.329 (25°C) (calculated)	79
Isopropyl Isostearate		
form	liquid	2
specific gravity	0.853 – 0.859 (25°C)	2
solubility	soluble in acetone, ethyl acetate, isopropyl alcohol, and mineral oil	2
Isopropyl Laurate		
form	yellow oil	76
molecular weight	242.40	79
boiling point	196°C	81
specific gravity	0.851-0.857	87
refractive index	1.427-1.433 (20°C)	87
solubility	insoluble in water solubility in 95% ethanol, 1 ml in 1 ml	87
log P	6.234 (25°C) (calculated)	79
Isopropyl Linoleate		
molecular weight	322.53	79
boiling point	399.0°C (760 Torr) (calculated)	79
density	0.880 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	8.478 (25°C) (calculated)	79
Isopropyl Myristate		
characteristics	colorless, almost odorless liquid with a bland taste	10
boiling point	192.6°C (20 mm Hg)	10
specific gravity	0.847 – 0.853 (25°C)	10
refractive index	1.432 – 1.430 (25°C)	10
solubility	soluble in acetone, castor oil, chloroform, cottonseed oil, ethanol, ethyl acetate, mineral oil, and toluene insoluble in water, glycerol, sorbitan, and propylene glycol	10

Table 7. Chemical and physical properties

Property	Description	Reference
Isopropyl Oleate		
molecular weight	324.54	80
melting point	-33.4°C	22
boiling point	369.8°C (760 Torr) (calculated)	79
density	0.870 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	8.881 (25°C) (calculated)	79
Isopropyl Palmitate		
molecular weight	318	9
characteristics	colorless, almost odorless, mobile liquid mixture of isopropyl esters consisting of a minimum of 60% isopropyl palmitate	9
melting point	11°C	9
specific gravity	0.850 – 0.855 (25°C)	9
refractive index	1.4355 – 1.4375 (25°C)	9
solubility	soluble in acetone, castor oil, chloroform, cottonseed oil, ethyl acetate, ethanol, and mineral oil insoluble in water, glycerin, and propylene glycol	9
Isopropyl Stearate		
form	liquid at room temperature	11
molecular weight	326	11
Isostearyl Hydroxystearate		
molecular weight	552.96	79
boiling point	607.3°C (760 Torr) (calculated)	79
density	0.885 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	14.870 (25°C) (calculated)	79
Isostearyl Isononanoate		
molecular weight	410.72	19
log P	10.02 calculated)	19
Isostearyl Isostearate		
molecular weight	536.96	80
log P	17.399 (calculated)	40
Isostearyl Neopentanoate		
form	clear, slightly yellow liquid	12
molecular weight	348-390	12
refractive index	1.4485 – 1.4515 (25°C)	12
specific gravity	0.858 – 0.870 (25°C)	12
saponification value	144 – 161	12
solubility	soluble in mineral oil, 95% ethanol, propylene glycol , isopropyl myristate, oleyl alcohol, peanut oil insoluble in water, 80% ethanol,	12
Isotridecyl Isononanoate		
molecular weight	340.58	19
refractive index	1.433 – 1.445 (25°C)	19
specific gravity	0.859 – 0.861 (25°/25°C)	19
saponification value	155 - 162	19
log P	7.94 (calculated)	19
Isotridecyl Laurate		
molecular weight	382.66	79
boiling point	419.6°C (760 Torr) (calculated)	79
density	0.859 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	11.329 (25°C) (calculated)	79
Isotridecyl Stearate		
molecular weight	466.82	80
Lauryl Behenate		
molecular weight	508.90	79
melting point	53°C	74
boiling point	528.4°C (760 Torr) (calculated)	79
specific gravity	0.8295 – 0.8137 (60 - 90°C, respectively)	74
refractive index	1.443 – 1.433 (60 - 80°C, respectively)	74
log P	16.070 (25°C) (calculated)	79
Lauryl Laurate		
molecular weight	368.64	79
melting point	27°C	88
boiling point	226°C	88
density	0.860 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	10.975 (25°C) (calculated)	79
Lauryl Oleate		
molecular weight	485.75	79
melting point	14.5°C	89
	18.4°C	22
boiling point	519.6°C (760 Torr) (calculated)	79
density	0.865g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	13.623 (25°C) (calculated)	79
Lauryl Palmitate		
molecular weight	424.74	79
boiling point	462.2°C (760 Torr) (calculated)	79
density	0.859 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	13.013 (25°C) (calculated)	79

Table 7. Chemical and physical properties

Property	Description	Reference
Lauryl Stearate		
molecular weight	452.08	79
boiling point	484.9°C (760 Torr) (calculated)	79
density	0.858 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	14.032 (25°C) (calculated)	79
Myristyl Laurate		
molecular weight	396.69	79
boiling point	438.7°C (760 Torr) (calculated)	79
density	0.860 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	11.994 (25°C) (calculated)	79
Myristyl Myristate		
melting point	37-39°C	10
saponification value	119 - 129	10
Myristyl Neopentanoate		
molecular weight	298.50	79
boiling point	332.3°C (760 Torr) (calculated)	79
density	0.863 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	8.173 (25°C) (calculated)	79
Myristyl Laurate		
melting point	40-40.4°C	78
Myristyl Stearate		
molecular weight	480.85	79
form	waxy solid at room temperature	11
Octyldodecyl Behenate		
molecular weight	621.12	79
boiling point	603.0°C (760 Torr) (calculated)	79
density	0.855 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	19.990 (25°C) (calculated)	79
Octyldodecyl Erucate		
molecular weight	619.10	79
boiling point	646.0°C (760 Torr) (calculated)	79
density	0.860 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	19.581 (25°C) (calculated)	79
Octyldodecyl Myristate		
characteristics	colorless odorless liquid	16
saponification value	105 - 111	16
Octyldodecyl Neopentanoate		
molecular weight	382.66	79
boiling point	405.6°C (760 Torr) (calculated)	79
density	0.859 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	11.074 (25°C) (calculated)	79
Octyldodecyl Oleate		
molecular weight	562.99	79
boiling point	608.2°C (760 Torr) (calculated)	79
density	0.861 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	17.543 (25°C) (calculated)	79
Octyldodecyl Stearate		
molecular weight	565.01	79
boiling point	563.8°C (760 Torr) (calculated)	79
density	0.856 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	17.952 (25°C) (calculated)	79
Oleyl Arachidate		
molecular weight	562.99	79
melting point	39.5-40°C	78
boiling point	617.5°C (760 Torr) (calculated)	79
density	0.862 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	17.699 (25°C) (calculated)	79
Oleyl Erucate		
molecular weight	589.03	79
boiling point	637.7°C (760 Torr) (calculated)	79
density	0.866 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	18.308 (25°C) (calculated)	79
Oleyl Linoleate		
molecular weight	530.91	79
boiling point	595.5°C (760 Torr) (calculated)	79
density	0.874 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	15.867 (25°C) (calculated)	79
Oleyl Oleate		
molecular weight	532.92	79
melting point	-4.0 to -3.5°C	78
	-1.5°C	22
boiling point	596.5°C (760 Torr) (calculated)	79
density	0.868 g/cm^3 (20°C; 760 Torr) (calculated)	79
log P	16.270 (25°C) (calculated)	79

Table 7. Chemical and physical properties

Property	Description	Reference
Oleyl Stearate		
molecular weight	534.94	[79]
melting point	34.0-34.5°C	[78]
boiling point	595.8°C (760 Torr) (calculated)	[79]
density	0.862 g/cm^3 (20°C; 760 Torr) (calculated)	[79]
log P	16.680 (25°C) (calculated)	[79]
Propylheptyl Caprylate		
molecular weight	284.48	[79]
purity	>80%	[44]
melting point	-38.9°C	[44]
boiling point	319.0°C (101.3 kPa)	[44]
water solubility	<0.01 mg/l (20°C)	[44]
density	0.863 g/cm^3 (20°C; 760 Torr) (calculated)	[79]
log P	7.963 (25°C) (calculated)	[79]
Stearyl Erucate		
molecular weight	591.05	[79]
boiling point	627.8°C (760 Torr) (calculated)	[79]
density	0.861 g/cm^3 (20°C; 760 Torr) (calculated)	[79]
log P	18.718 (25°C) (calculated)	[79]
Stearyl Linoleate		
molecular weight	532.92	[79]
boiling point	590.8°C (760 Torr) (calculated)	[79]
density	0.868 g/cm^3 (20°C; 760 Torr) (calculated)	[79]
log P	16.276 (25°C) (calculated)	[79]
Tetradecyloctadecyl Hexyldecanoate		
molecular weight	705.27	[79]
boiling point	653.7°C (760 Torr) (calculated)	[79]
density	0.854 g/cm^3 (20°C; 760 Torr) (calculated)	[79]
log P	22.891 (25°C) (calculated)	[79]
Tridecyl Behenate		
molecular weight	522.93	[79]
boiling point	538.8°C (760 Torr) (calculated)	[79]
density	0.857 g/cm^3 (20°C; 760 Torr) (calculated)	[79]
log P	16.579 (25°C) (calculated)	[79]
Tridecyl Erucate		
molecular weight	520.91	[79]
boiling point	573.1°C (760 Torr) (calculated)	[79]
density	0.863 g/cm^3 (20°C; 760 Torr) (calculated)	[79]
log P	16.170 (25°C) (calculated)	[79]
Tridecyl Laurate		
molecular weight	382.66	[79]
boiling point	426.6°C (760 Torr) (calculated)	[79]
density	0.860 g/cm^3 (20°C; 760 Torr) (calculated)	[79]
log P	11.485 (25°C) (calculated)	[79]
Tridecyl Isononanoate		
molecular weight	340.58	[19]
log P	8.02 (calculated)	[19]
Tridecyl Stearate		
molecular weight	466.82	[79]
boiling point	496.0°C (760 Torr) (calculated)	[79]
density	0.858 g/cm^3 (20°C; 760 Torr) (calculated)	[79]
log P	14.541 (25°C) (calculated)	[79]

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses	*Max Conc of Use (%)*	*# of Uses*		*Max Conc of Use (%)*		*# of Uses*	*Max Conc of Use (%)*
	Arachidyl Behenate		**Arachidyl Propionate**				**Behenyl Beeswax**	
	2013[25]	**2012[26]**	**2013[25]**	**2005[7]**	**2012[26]**	**1987[13]/ 2006[7]**	**2013[25]**	**2012[26]**
Totals*	**20**	**0.3-4**	**48**	**47**	**0.0003-14.2**	**≤10**	**1**	**0.4**
Duration of Use								
Leave-On	*20*	*0.3-4*	*40*	*44*	*0.002-14.2*	*≤10*	*1*	*0.4*
Rinse-Off	*NR*	*NR*	*8*	*3*	*0.0003-14.1*	*0.002*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type								
Eye Area	5	3	3	NR	3-14	5	1	0.4
Incidental Ingestion	2	3-4	6	8	8-15	≤10	NR	NR
Incidental Inhalation-Spray[#]	NR	NR	NR	1[b]	14[a] 0.0002 (spray)	≤5[b]	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	14	NR	NR	NR
Dermal Contact	18	0.3-3	37	35	0.002-14.2	≤5	NR	0.4
Deodorant (underarm)	NR	NR	NR	NR	14.1 (not a spray)	NR	NR	NR
Hair - Non-Coloring	NR	NR	5	4	0.0003-0.003	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	0.05-0.09	0.04	NR	NR
Mucous Membrane	2	3-4	7	8	8-15	≤10	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR

	Behenyl Behenate		**Behenyl Erucate**		**Behenyl Olivate**	
	2013[25]	**2012[26]**	**2013[25]**	**2012[26]**	**2013[25]**	**2012[26]**
Totals*	**6**	**0.4-5**	**9**	**0.5**	**NR**	**0.5**
Duration of Use						
Leave-On	*6*	*0.4-5*	*9*	*0.5*	*NR*	*0.5*
Rinse Off	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type						
Eye Area	3	0.6-5	NR	NR	NR	NR
Incidental Ingestion	NR	4	9	0.5	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	5	0.4-2	NR	NR	NR	0.5
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	4	9	0.5	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR

	Butyl Avocadate		**Butyl Myristate**				**Butyl Stearate**			
	2013[25]	**2012[26]**	**2013[25]**	**2007[16]**	**2012[26]**	**2008[16]**	**2013[25]**	**2002[5]**	**2012[26]**	**1985[11]/ 2003[5]**
Totals*	**11**	**1**	**4**	**26**	**5**	**NR**	**55**	**78**	**0.0008-12**	**0.002-43**
Duration of Use										
Leave-On	*7*	*1*	*4*	*26*	*5*	*NR*	*10*	*73*	*0.002-12*	*0.002-25*
Rinse-Off	*4*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*5*	*0.0008-2*	*0.001-10*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*43*
Exposure Type										
Eye Area	NR	NR	NR	NR	NR	NR	5	23	0.4-9	0.2-25
Incidental Ingestion	NR	NR	NR	16	NR	NR	2	34	0.1-12	0.02-25
Incidental Inhalation-Spray	1[a]	NR	NR	NR	NR	NR	NR	NR	0.6[a]-5	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR	NR	NR	0.5-2	NR
Dermal Contact	7	1	4	10	NR	NR	8	44	0.0008-9	0.02-43
Deodorant (underarm)	NR	NR	NR	NR	NR	NR	NR	1	0.6 (not a spray)	>1-5[b]
Hair - Non-Coloring	4	NR	NR	NR	5	NR	NR	NR	NR	0.01-10
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR	NR	NR	NR	>0.1-5
Mucous Membrane	NR	NR	NR	16	NR	NR	2	39	0.1-12	0.1-43
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses	*Max Conc of Use (%)*	*# of Uses*	*Max Conc of Use (%)*	*# of Uses*	*Max Conc of Use (%)*
	C20-40 Alkyl Stearate		**Caprylyl Caprylate**		**Caprylyl Eicosenoate**	
	2013[25]	**2012[26]**	**2013[25]**	**2012[26]**	**2013[25]**	**2012[26]**
Totals*	**11**	**NR**	**11**	**NR**	**2**	**0.3**
Duration of Use						
Leave-On	*11*	*NR*	*11*	*NR*	*2*	*0.3*
Rinse-Off	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type						
Eye Area	NR	NR	1	NR	NR	NR
Incidental Ingestion	8	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	0.3
Dermal Contact	NR	NR	11	NR	2	0.3
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	3	NR	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	8	NR	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR

	Cetearyl Behenate		**Cetearyl Candelillate**		**Cetearyl Isononanoate**			
	2013[25]	**2012[26]**	**2013[25]**	**2012[26]**	**2013[25]**	**2009[19]**	**2012[26]**	**2009[19]**
Totals*	**3**	**7-15**	**2**	**6**	**168**	**123**	**0.2-40**	**0.05-50**
Duration of Use								
Leave-On	*3*	*7-15*	*2*	*6*	*145*	*108*	*0.2-40*	*0.05-50*
Rinse-Off	*NR*	*NR*	*NR*	*NR*	*23*	*15*	*1-4*	*2-3*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type								
Eye Area	1	NR	NR	NR	22	15	NR	0.05
Incidental Ingestion	NR	7	1	6	1	1	5	NR
Incidental Inhalation-Spray	NR	NR	1[a]	NR	7[a]	7[a,b]	40 (spray) 6 (pump spray)	27-50[b]
Incidental Inhalation-Powder	NR	NR	NR	NR	1	2	NR	0.05-11
Dermal Contact	3	14-15	1	NR	163	120	0.2-40	0.05-50
Deodorant (underarm)	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	3	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	1	2	NR	NR
Mucous Membrane	NR	7	1	6	3	3	5	NR
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR

	Cetearyl Nonanoate				**Cetearyl Olivate**		**Cetearyl Stearate**	
	2013[25]	**2009[19]**	**2012[26]**	**2009[19]**	**2013[25]**	**2012[27]**	**2013[25]**	**2012[27]**
Totals*	**NR**	**NR**	**NR**	**3**	**152**	**0.3-3**	**3**	**NR**
Duration of Use								
Leave-On	*NR*	*NR*	*NR*	*3*	*118*	*0.3-3*	*3*	*NR*
Rinse-Off	*NR*	*NR*	*NR*	*NR*	*34*	*0.4-2*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*2[a]*	*NR*	*NR*
Exposure Type								
Eye Area	NR	NR	NR	NR	15	1-3	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	2[a]	2[a]	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	1	NR	NR	NR
Dermal Contact	NR	NR	NR	3	147	0.3-3	3	NR
Deodorant (underarm)	NR	NR	NR	NR	3[b]	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	3	2	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	NR	NR	3	NR	NR	NR
Baby Products	NR	NR	NR	NR	1	NR	NR	NR

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses	*Max Conc of Use (%)*	*# of Uses*	*Max Conc of Use (%)*	*# of Uses*	*Max Conc of Use (%)*
	Cetyl Babassuate		**Cetyl Caprate**		**Cetyl Caprylate**	
	2013[25]	**2012[26]**	**2013[25]**	**2012[26]**	**2013[25]**	**2012[26]**
Totals*	**2**	**NR**	**NR**	**0.5**	**14**	**2-4**
Duration of Use						
Leave-On	*2*	*NR*	*NR*	*0.5*	*12*	*2-4*
Rinse-Off	*NR*	*NR*	*NR*	*NR*	*2*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type						
Eye Area	NR	NR	NR	NR	1	NR
Incidental Ingestion	NR	NR	NR	0.5	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	2	NR
Dermal Contact	2	NR	NR	NR	14	2-4
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	NR	0.5	NR	NR
Baby Products	NR	NR	NR	NR	2	NR

	Cetyl Esters				**Cetyl Isononanoate**				**Cetyl Laurate**	
	2013[25]	**1995[1]**	**2012[27]**	**1995[1]**	**2013[25]**	**2009[19]**	**2012[26]**	**2009[19]**	**2013[25]**	**2012[26]**
Totals*	**476**	**210**	**0.7 – 30**	**7**	**NR**	**NR**	**NR**	**1-5**	**1**	**NR**
Duration of Use										
Leave-On	*240*	*168*	*0.8-30*	*7*	*NR*	*NR*	*NR*	*1-5*	*1*	*NR*
Rinse-Off	*236*	*42*	*0.7-5*	*7*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type										
Eye Area	24	9	3-4	NS	NR	NR	NR	1	NR	NR
Incidental Ingestion	8	26	3-11.5	NS	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	5[a]	6[a]	NR	NS	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	1	NR	NR	NS	NR	NR	NR	NR	NR	NR
Dermal Contact	183	156	0.8-5	NS	NR	NR	NR	1-5	1	NR
Deodorant (underarm)	1[b]	5[b]	NR	NS	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	282	11	0.7-5	NS	NR	NR	NR	1	NR	NR
Hair-Coloring	3	15	NR	NS	NR	NR	NR	NR	NR	NR
Nail	NR	1	NR	NS	NR	NR	NR	NR	NR	NR
Mucous Membrane	11	30	NR	NS	NR	NR	NR	NR	NR	NR
Baby Products	1	NR	NR	NS	NR	NR	NR	NR	NR	NR

	Cetyl Myristate				**Cetyl Palmitate**				**Cetyl Ricinoleate**			
	2013[25]	**2007[16]**	**2012[26]**	**2008[16]**	**2013[25]**	**2001[5]**	**2012[26]**	**1976[9]/2001[5]**	**2013[25]**	**2002[20]**	**2012[26]**	**2004[20]**
Totals*	**4**	**7**	**NR**	**6**	**511**	**236**	**0.002-11**	**0.01-11**	**137**	**55**	**0.3-16**	**0.1 - 10**
Duration of Use												
Leave-On	*4*	*7*	*NR*	*6*	*469*	*208*	*0.002-11*	*0.0-11*	*127*	*50*	*0.3-15.2*	*0.1-10*
Rinse-Off	*NR*	*NR*	*NR*	*NR*	*42*	*28*	*0.006-5*	*0.02-1*	*10*	*5*	*0.3*	*0.1-0.5*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type												
Eye Area	1	1	NR	NR	51	54	3-11	0.2-11	14	NR	0.3-5	NR
Incidental Ingestion	NR	NR	NR	NR	22	10	2-7	10	31	26	2-15.2	0.5-10
Incidental Inhalation-Spray	NR	NR	NR	NR	16[a]	13[a,b]	0.4[a]-6; 8 (pump spray)	2[a]	1[a]	1[a]	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR	0.8	NR	4	NR	NR	NR
Dermal Contact	4	7	NR	6	442	213	0.002-11	0.02-11	106	29	0.3-6	0.1-4
Deodorant (underarm)	NR	NR	NR	NR	2[b]	NR	NR	0.3[b]	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	9	12	2	1	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	0.8	0.2	NR	NR	NR	NR
Nail	NR	NR	NR	NR	2	NR	2-7	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	NR	NR	26	10	0.006-7	0.02-10	31	26	2-15.2	0.5-10
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses		Max Conc of Use (%)		# of Uses	Max Conc of Use (%)	# of Uses	Max Conc of Use (%)
	Cetyl Stearate				Cetyl Tallowate		Coco-Caprylate	
	2013[25]	2002[5]	2012[26]	1985[11]/ 2003[5]	2013[25]	2012[26]	2013[25]	2012[26]
Totals	**5**	**2**	**1-4**	**0.3-15**	**1**	**NR**	**8**	**NR**
Duration of Use								
Leave-On	*5*	*2*	*4*	*0.3-15*	*1*	*NR*	*6*	*NR*
Rinse Off	*NR*	*NR*	*1*	*0.6-3*	*NR*	*NR*	*2*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type								
Eye Area	2	NR	NR	0.6-10	NR	NR	1	NR
Incidental Ingestion	NR	2	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	>1-5	NR	NR	NR	NR
Dermal Contact	5	NR	NR	0.3-15	1	NR	5	NR
Deodorant (underarm)	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	1-4	2-3	NR	NR	3	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	2	NR	NR	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR

	Coco-Caprylate/Caprate		Decyl Cocoate				Decyl Oleate			
	2013[25]	2012[26]	2013[25]	2007[17]	2012[26]	2008[17]	2013[25]	2001[4]	2012[26]	1976[23]/ 2001[4]
Totals	**261**	**0.5-62**	**5**	**NR**	**NR**	**NR**	**227**	**147**	**0.5-20**	**≤0.1-88**
Duration of Use										
Leave-On	*232*	*0.5-35*	*3*	*NR*	*NR*	*NR*	*214*	*121*	*0.5-4*	*0.5-88*
Rinse Off	*23*	*1-62*	*2*	*NR*	*NR*	*NR*	*13*	*25*	*2-20*	*≤0.1-25*
Diluted for (Bath) Use	*6*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*1*	*NR*	*>5-25*
Exposure Type										
Eye Area	43	0.7-35	NR	NR	NR	NR	5	NR	20	>1- >50
Incidental Ingestion	8	0.5-9	NR	NR	NR	NR	NR	1	NR	8
Incidental Inhalation-Spray	14[a]	2-6[a]	NR	NR	NR	NR	NR	3	2 (pump spray)	>0.1-1 (spray); >1-88[a,b]
Incidental Inhalation-Powder	2	4-16	NR	NR	NR	NR	NR	1	NR	NR
Dermal Contact	252	0.5-62	5	NR	NR	NR	218	137	0.5-20	≤0.1-88
Deodorant (underarm)	NR	NR	NR	NR	NR	NR	1[b]	1[b]	NR	NR
Hair - Non-Coloring	1	30	NR	NR	NR	NR	9	6	2-3	>0.1-1
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR	2	3
Nail	NR	NR	NR	NR	NR	NR	1	3	NR	>5-10
Mucous Membrane	9	0.5-9	NR	NR	NR	NR	NR	1	NR	>5-88
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR	NR	>1-5

	Decyl Olivate		Ethylhexyl Cocoate				Ethylhexyl Hydroxystearate	
	2013[25]	2012[26]	2013[25]	2007[17]	2012[26]	2008[17]	2013[25]	2012[26]
Totals*	**1**	**NR**	**94**	**18**	**0.0006-41**	**0.01-41**	**270**	**0.09-18**
Duration of Use								
Leave-On	*1*	*NR*	*81*	*17*	*0.0006-41*	*0.01-41*	*243*	*0.1-18*
Rinse-Off	*NR*	*NR*	*13*	*1*	*5-9*	*3-5*	*27*	*0.09-3*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*6*	*6*	*NR*	*3*
Exposure Type								
Eye Area	NR	NR	9	5	12	0.02-2	18	2-8
Incidental Ingestion	NR	NR	4	NR	8	0.01-19	81	2-18
Incidental Inhalation-Spray	NR	NR	11[a]	1	NR	4-10[a]	3[a]	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR	1	NR
Dermal Contact	1	NR	85	16	2-41	0.02-41	186	0.1-9
Deodorant (underarm)	NR	NR	NR	NR	NR	5[b]	NR	NR
Hair - Non-Coloring	NR	NR	2	2	NR	NR	4	0.09-2
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	3	NR	0.0006	NR	NR	NR
Mucous Membrane	NR	NR	5	NR	8	0.01-19	94	0.2-18
Baby Products	NR	NR	NR	NR	NR	5	NR	NR

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses		Max Conc of Use (%)		# of Uses	Max Conc of Use (%)	# of Uses	Max Conc of Use (%)
	Ethylhexyl Isononanoate				Ethylhexyl Isopalmitate		Ethylhexyl Isostearate	
	2013[25]	2009[19]	2012[26]	2009[19]	2013[25]	2012[26]	2013[25]	2012[26]
Totals*	**144**	**116**	**0.02-75**	**0.02-74**	**7**	**NR**	**9**	**27-40**
Duration of Use								
Leave-On	*141*	*112*	*0.02-75*	*0.02-74*	*7*	*NR*	*9*	*27-40*
Rinse-Off	*3*	*4*	*0.3-20*	*0.8-1*	*NR*	*NR*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type								
Eye Area	10		0.8-20	0.8-65	1	NR	9	27-40
Incidental Ingestion	NR	9	2	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	27[a]	27[a,b]	0.02-0.1[a]; 2; 4 (pump spray)	18 0.03-7[a,b]	1[a]	NR	NR	NR
Incidental Inhalation-Powder	3	NR	NR	3	NR	NR	NR	NR
Dermal Contact	139	102	0.02-75	0.02-74	7	NR	9	27-40
Deodorant (underarm)	NR	NR	3 (not spray)	NR	NR	NR	NR	NR
Hair - Non-Coloring	5	4	8	0.8-8	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR	NR	NR
Mucous Membrane	1	10	2	NR	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR

	Ethylhexyl Laurate		Ethylhexyl Myristate				Ethylhexyl Olivate	
	2013[25]	2012[26]	2013[25]	2007[16]	2012[26]	2008[16]	2013[25]	2012[26]
Totals*	**1**	**NR**	**2**	**NR**	**NR**	**NR**	**2**	**NR**
Duration of Use								
Leave-On	*1*	*NR*	*1*	*NR*	*NR*	*NR*	*2*	*NR*
Rinse-Off	*NR*	*NR*	*1*	*NR*	*NR*	*NR*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type								
Eye Area	NR	NR	NR	NR	NR	NR	1	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR	NR	NR
Dermal Contact	1	NR	2	NR	NR	NR	2	NR
Deodorant (underarm)	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	NR	NR	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR

	Ethylhexyl Palmitate				Ethylhexyl Pelargonate				Ethylhexyl Stearate			
	2013[25]	2001[5]	2012[26]	1976[9]/ 2001[5]	2013[25]	2009[19]	2012[26]	2009[19]	2013[25]	2002[5]	2012[26]	1985[11]/ 2003[5]
Totals	**1525**	**417**	**0.0003-78**	**0.1 - >50**	**14**	**3**	**2-4**	**2-25**	**335**	**31**	**0.0004-38**	**>0.1-25**
Duration of Use												
Leave-On	*1475*	*407*	*0.0003-78*	*0.1 - >50*	*2*	*2*	*2*	*3-25*	*305*	*27*	*0.0004-38*	*>0.1-25*
Rinse Off	*48*	*10*	*0.05-50*	*2-21*	*12*	*1*	*3-4*	*2-5*	*25*	*2*	*0.1-29*	*NR*
Diluted for (Bath) Use	*2*	*NR*	*10*	*6-23*	*NR*	*NR*	*NR*	*NR*	*5*	*2*	*NR*	*>0.1-5*
Exposure Type												
Eye Area	424	141	0.01-50	0.2- >50	NR	NR	NR	2	38	5	0.003-38	0.8-11
Incidental Ingestion	221	100	NR	4-42	NR	NR	NR	NR	7	1	19-27.1	NR
Incidental Inhalation-Spray	53[a]	2[b]	3-16; 4-45 (aerosol); 0.4 (pump spray)	21 (spray) 0.5- >50[a,b]	NR	NR	NR	NR	16[a]	5[a,b]	2-10[a]	NR
Incidental Inhalation-Powder	80	13	0.3-10	0.3-22	NR	NR	NR	NR	10	2	6	0.5
Dermal Contact	1276	314	0.003-78	0.1- >50	3	3	2	2-25	327	31	0.0004-38	>0.1-25
Deodorant (underarm)	8[b]	1	1 (aerosol)	2[b]	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	18	NR	2-4	2-17	NR	NR	NR	NR	8	NR	5	NR
Hair-Coloring	NR	NR	NR	NR	11	NR	3-4	5	NR	NR	29	NR
Nail	15	3	5-50	5-28	NR	NR	NR	NR	NR	NR	NR	NR
Mucous Membrane	228	100	1-10	4-42	NR	NR	NR	NR	14	3	5-27.1	>0.1-5
Baby Products	2	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses	Max Conc of Use (%)	# of Uses	Max Conc of Use (%)	# of Uses	Max Conc of Use (%)
	Heptyl Undecylenate		**Heptylundecyl Hydroxystearate**		**Hexyl Isostearate**	
	2013[25]	**2012[26]**	**2013[25]**	**2012[26]**	**2013[25]**	**2012[26]**
Totals*	**10**	**0.01-26**	**10**	**20**	**NR**	**0.008-0.04**
Duration of Use						
Leave-On	*9*	*0.01-26*	*10*	*20*	*NR*	*0.008-0.04*
Rinse-Off	*1*	*0.01-0.1*	*NR*	*NR*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type						
Eye Area	3	26	8	NR	NR	NR
Incidental Ingestion	3	NR	2	20	NR	NR
Incidental Inhalation-Spray	NR	0.01 (pump spray)	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	5	10-26	8	NR	NR	0.008
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	1	0.01-0.1	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	0.04
Mucous Membrane	3	NR	2	20	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR
	Hexyl Laurate		**Hexyldecyl Isostearate**		**Hexyldecyl Laurate**	
	2013[25]	**2012[26]**	**2013[25]**	**2012[26]**	**2013[25]**	**2012[26]**
Totals*	**213**	**0.07-3**	**NR**	**0.2-2**	**41**	**1-2**
Duration of Use						
Leave-On	210	*0.07-3*	*NR*	*2*	*35*	*2*
Rinse-Off	*3*	*2*	*NR*	*0.2-7*	*6*	*2*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type						
Eye Area	19	0.3-3	NR	NR	2	NR
Incidental Ingestion	28	0.1-2	NR	NR	NR	NR
Incidental Inhalation-Spray	11[a]	0.07-0.1	NR	NR	NR	NR
Incidental Inhalation-Powder	7	2	NR	NR	NR	NR
Dermal Contact	178	0.07-3	NR	0.2-2	40	1-2
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	2	2-3	NR	0.7-2	1	2
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	1	2	NR	NR	NR	NR
Mucous Membrane	28	0.1-2	NR	NR	NR	NR
Baby Products	3	NR	NR	NR	NR	NR
	Hexyldecyl Stearate		**Hydrogenated Ethylhexyl Olivate**		**Hydroxyoctacosanyl Hydroxystearate**	
	2013[25]	**2012[26]**	**2013[25]**	**2012[26]**	**2013[25]**	**2012[26]**
Totals	**34**	**0.5-13**	**8**	**0.05-15.5**	**5**	**NR**
Duration of Use						
Leave-On	*45*	*0.5-13*	*7*	*4-15.5*	*5*	*NR*
Rinse Off	*9*	*3*	*1*	*0.05*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type						
Eye Area	2	3	2	4	1	NR
Incidental Ingestion	NR	0.9	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	15.5 (pump spray)	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	34	0.5-13	6	4-7	5	NR
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	2	0.05-15.5	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses	Max Conc of Use (%)	# of Uses	Max Conc of Use (%)			# of Uses	Max Conc of Use (%)		
	Isoamyl Laurate		Isobutyl Myristate				Isobutyl Stearate			
Totals	**2013[25]**	**2012[26]**	**2013[25]**	**2007[16]**	**2012[26]**	**2008[16]**	**2013[25]**	**2002[5]**	**2012[26]**	**2003[5]**
Duration of Use	**NR**	**1-2**	**NR**	**NR**	**NR**	**3-30**	**NR**	**3**	**NR**	**7**
Leave-On	*NR*	*1*	*NR*	*NR*	*NR*	*3-30*	*NR*	*2*	*NR*	*7*
Rinse Off	*NR*	*2*	*NR*	*NR*	*NR*	*10*	*NR*	*1*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type										
Eye Area	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	3[a]	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dermal Contact	NR	NR	NR	NR	NR	3-30	NR	3	NR	7
Deodorant (underarm)	NR	1-2	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	NR	NR	NR	NR	NR	1	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Isocetyl Behenate		Isocetyl Myristate				Isocetyl Palmitate			
	2013[25]	**2012[26]**	**2013[25]**	**2007[16]**	**2012[26]**	**2008[16]**	**2013[25]**		**2012[26]**	
Totals	**1**	**NR**	**11**	**6**	**0.4-37**	**NR**	**5**		**NR**	
Duration of Use										
Leave-On	*1*	*NR*	*10*	*NR*	*0.4-36.5*	*NR*	*5*		*NR*	
Rinse Off	*NR*	*NR*	*1*	*NR*	*NR*	*NR*	*NR*		*NR*	
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*		*NR*	
Exposure Type										
Eye Area	NR	NR	3	NR	NR	NR	NR		NR	
Incidental Ingestion	NR	NR	NR	NR	NR	NR	NR		NR	
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR	NR		NR	
Incidental Inhalation-Powder	NR	NR	1	NR	0.4-2	NR	NR		NR	
Dermal Contact	1	NR	11	NR	0.4-36.5	NR	5		NR	
Deodorant (underarm)	NR	NR	NR	NR	NR	NR	NR		NR	
Hair - Non-Coloring	NR	NR	NR	NR	NR	NR	NR		NR	
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR		NR	
Nail	NR	NR	NR	NR	NR	NR	NR		NR	
Mucous Membrane	NR	NR	NR	NR	NR	NR	NR		NR	
Baby Products	NR	NR	NR	NR	NR	NR	NR		NR	
	Isocetyl Stearate				Isodecyl Cocoate				Isodecyl Isononanoate			
	2013[25]	**2002[5]**	**2012[26]**	**1985[11]/ 2003[5]**	**2013[25]**	**2007[17]**	**2012[26]**	**2008[17]**	**2013[25]**	**2009[19]**	**2012[26]**	**2009[19]**
Totals*	**230**	**84**	**0.1-34**	**0.02-30**	**NR**	**NR**	**2**	**NR**	**38**	**26**	**1-43.5**	**0.05-59**
Duration of Use												
Leave-On	*216*	*77*	*0.1-34*	*0.1-30*	*NR*	*NR*	*2*	*NR*	*35*	*24*	*1-43.5*	*0.05-59*
Rinse-Off	*14*	*7*	*0.6-5*	*0.02-30*	*NR*	*NR*	*NR*	*NR*	*3*	*2*	*10*	*2-10*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type												
Eye Area	3	2	0.1-16	30	NR	NR	NR	NR	7	2	1-40	6-21
Incidental Ingestion	22	4	0.3-24	0.1-24	NR	NR	NR	NR	4	NR	40-43.5	0.05-18
Incidental Inhalation-Spray	3[a]	NR	0.6[a] 34 (pump spray)	10	NR	NR	NR	NR	2[a]	2[a]	NR	5[a]
Incidental Inhalation-Powder	3	NR	NR	>1-25	NR	NR	NR	NR	NR	NR	NR	NR
Dermal Contact	200	79	0.1-34	0.02-30	NR	NR	2	NR	34	25	1-40	2-59
Deodorant (underarm)	NR	NR	NR	3	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	8	NR	0.5-1	NR	NR	NR	NR	NR	NR	1	NR	2
Hair-Coloring	NR	NR	0.6	NR	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	1	NR	>1-5	NR	NR	NR	NR	NR	NR	NR	NR
Mucous Membrane	22	4	0.3-24	0.1-30	NR	NR	NR	NR	4	NR	40-43.5	0.05-18
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses	Max Conc of Use (%)	# of Uses	Max Conc of Use (%)	# of Uses	Max Conc of Use (%)
	Isodecyl Laurate		**Isodecyl Myristate**		**Isodecyl Neopentanoate**	
	2013[25]	**2012[26]**	**2013[25]**	**2007[16] 2012[26] 2008[16]**	**2013[25]**	**2012[26]**
Totals*	**4**	**NR**	**1**	**1 NR NR**	**137**	**0.05-17**
Duration of Use						
Leave-On	*2*	*NR*	*1*	*1 NR NR*	*131*	0.05-17
Rinse-Off	*2*	*NR*	*NR*	*NR NR NR*	*6*	0.1-2
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR NR NR*	*NR*	NR
Exposure Type						
Eye Area	2	NR	1	NR NR NR	29	1-17
Incidental Ingestion	NR	NR	NR	NR NR NR	7	0.6-5
Incidental Inhalation-Spray	NR	NR	NR	NR NR NR	7[a]	3 0.5 (aerosol) 0.3 (pump spray)
Incidental Inhalation-Powder	NR	NR	NR	NR NR NR	4	2
Dermal Contact	4	NR	1	1 NR NR	126	0.05-17
Deodorant (underarm)	NR	NR	NR	NR NR NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR NR NR	1	0.3-2
Hair-Coloring	NR	NR	NR	NR NR NR	NR	NR
Nail	NR	NR	NR	NR NR NR	NR	NR
Mucous Membrane	NR	NR	NR	NR NR NR	7	0.6-5
Baby Products	NR	NR	NR	NR NR NR	NR	3

	Isodecyl Oleate				**Isohexyl Caprate**		**Isononyl Isononanoate**			
	2013[25]	**2001[4]**	**2012[26]**	**1976[23]/ 2001[4]**	**2013[25]**	**2012[26]**	**2013[25]**	**2009[19]**	**2012[26]**	**2009[19]**
Totals*	**15**	**44**	**0.07-4**	**>0.1 – 25**	**3**	**NR**	**687**	**343**	**0.07-53**	**0.03-64**
Duration of Use										
Leave-On	*14*	*37*	*0.07-4*	*>1 - 25*	*3*	*NR*	*663*	*328*	*0.07-53*	*0.04-64*
Rinse-Off	*1*	*7*	*2-3*	*>1 - 25*	*NR*	*NR*	*25*	*15*	*0.3-25*	*0.03*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*>0.1 - 10*	*NR*	*NR*	*NR*	*NR*	*15*	*15*
Exposure Type										
Eye Area	NR	1	2	>1 - 5	NR	NR	95	47	0.8-53	2-26
Incidental Ingestion	NR	22	0.07	4-8	NR	NR	100	28	5-47	8-50
Incidental Inhalation-Spray	3	1	4 (aerosol) 2 (pump spray)	3[a]	NR	NR	32[a]	20[a,b]	0.1-6[a]; 26-45 0.4 (pump spray)	0.4-6; 0.08-21[a]; 21-46[b]
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR	29	12	4-9	2-15
Dermal Contact	4	17	2-3	>0.1-25	3	NR	582	314	0.07-53	0.04-64
Deodorant (underarm)	NR	NR	NR	>1-5	NR	NR	1[b]	1[b]	7 (not spray) 7 (aerosol)	3[b]
Hair - Non-Coloring	10	4	2-4	2	NR	NR	3	1	0.4-1	0.08-7
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR	NR	33
Nail	1	1	NR	NR	NR	NR	2	NR	6	0.4-5
Mucous Membrane	NR	22	0.07	>0.1-10	NR	NR	101	29	5-47	8-50
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR	3	NR

	Isopropyl Hydroxystearate		**Isopropyl Isostearate**				**Isopropyl Jojobate**	
	2013[25]	**2012[26]**	**2013[25]**	**2005[8]**	**2012[26]**	**1989[21]/ 2007[8]**	**2013[25]**	**2012[26]**
Totals	**NR**	**8**	**412**	**69**	**0.5-19**	≤0.1-65	**23**	**0.3-6**
Duration of Use								
Leave-On	*NR*	*8*	*400*	*63*	*0.5-19*	*≤0.1-30*	*23*	*0.3-6*
Rinse Off	*NR*	*NR*	*12*	*6*	*0.7-6*	*2-65*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type								
Eye Area	NR	8	233	9	0.8-10	0.6-8	4	0.7
Incidental Ingestion	NR	NR	24	NR	15-17	12-24	3	NR
Incidental Inhalation-Spray	NR	NR	7[a]	NR	0.6 (pump spray)	NR	1[a]	NR
Incidental Inhalation-Powder	NR	NR	18	2	2-19	0.6-30	NR	NR
Dermal Contact	NR	8	383	68	0.5-19	≤0.1-30	20	0.7-6
Deodorant (underarm)	NR	NR	NR	NR	NR	5	NR	NR
Hair - Non-Coloring	NR	NR	5	1	0.5-0.8	65	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	25	NR	15-17	12-24	3	NR
Baby Products	NR	NR	2	2	NR	NR	NR	NR

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses		*Max Conc of Use (%)*		*# of Uses*		*Max Conc of Use (%)*		*# of Uses*		*Max Conc of Use (%)*	
	Isopropyl Linoleate				**Isopropyl Myristate**				**Isopropyl Palmitate**			
	2013[25]	**1988[15]**	**2012[26]**	**1988[15]**	**2013[25]**	**2007[16]**	**2012[26]**	**2008[16]**	**2013[25]**	**2001[5]**	**2012[26]**	**1976[9] /2001[5]**
Totals	**NR**	**21[c]**	**0.1**	**>0.1–10[c]**	**1182**	**1057**	**0.000005-77.3**	**0.001-82**	**1125**	**535**	**0.0001-60**	**0.000002 - >50**
Duration of Use												
Leave-On	*NR*	*NS*	*0.1*	*NS*	*959*	*874*	*0.0002-77.3*	*0.001-82*	*995*	*434*	*0.0001-60*	*0.00001 - >50*
Rinse Off	*NR*	*NS*	*0.1*	*NS*	*208*	*160*	*0.000005-67*	*0.4-60*	*104*	*81*	*0.0003-31*	*0.000002-11*
Diluted for (Bath) Use	*NR*	*NS*	*NR*	*NS*	*15*	*23*	*1-22*	*2-23*	*26*	*20*	*0.001-60*	*0.3-60*
Exposure Type												
Eye Area	NR	NS	NR	NS	131	99	0.9-31	0.04-20	81	19	0.1-34	0.25-10
Incidental Ingestion	NR	NS	NR	NS	57	49	2-18	1-26	107	80	1-34	5-25
Incidental Inhalation-Spray	NR	NS	NR	NS	82[a]	55	0.6-36[a] 0.02-76.6 (aerosol)	0.02-10 1-58[b]	51[a]	43[a,b]	0.4-5[a]; 9-60[b] 0.8-17 (aerosol); 3-20 (pump spray)	0.2-60[a,b]
Incidental Inhalation-Powder	NR	NS	0.1	NS	29	19	0.7-3	0.3-4	37	12	3-18	0.00001 - 14
Dermal Contact	NR	NS	0.1	NS	942	893	0.0003-60	0.001-82	946	415	0.0001-60	0.000002 - >50
Deodorant (underarm)	NR	NS	NR	NS	23[b]	10	0.0003-23 (not spray) 0.03-23 (aerosol) 8 (pump spray)	0.08-51	16[b]	1[b]	0.5-17 (not spray) 3-5 (aerosol)	0.0023-17[b]
Hair - Non-Coloring	NR	NS	0.1	NS	151	107	0.000005-77.3	0.02-48	58	17	0.0003-20	0.00005 – 12
Hair-Coloring	NR	NS	NR	NS	22	5	30-68	22-30 (11-22 after dilution)	NR	16	44	>0.1 - 1
Nail	NR	NS	NR	NS	10	7	0.05-38	3-38	14	6	0.5-12	0.06-10
Mucous Membrane	NR	NS	NR	NS	114	91	1-22	1-60	153	91	0.05-34	0.00001 - 60
Baby Products	NR	NS	NR	NS	6	4	17	3	4	4	2-11	5
	Isopropyl Ricinoleate				**Isopropyl Stearate**				**Isostearyl Avocadate**			
	2013[25]	**2002[20]**	**2012[26]**	**2004[20]**	**2013[25]**	**2002[5]**	**2012[26]**	**1985[11]/ 2003[5]**	**2013[25]**		**2012[26]**	
Totals*	**NR**	**NR**	**2**	**NR**	**10**	**16**	**0.9-16**	**0.5-87**	**1**		**NR**	
Duration of Use												
Leave-On	*NR*	*NR*	*2*	*NR*	*9*	*12*	*1-16*	*0.5-50*	*1*		*NR*	
Rinse-Off	*NR*	*NR*	*NR*	*NR*	*1*	*4*	*0.9-9*	*6-87*	*NR*		*NR*	
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*7*	*>5-10*	*NR*		*NR*	
Exposure Type												
Eye Area	NR	NR	NR	NR	1	3	2	5-76	NR		NR	
Incidental Ingestion	NR	NR	2	NR	NR	NR	16	87	NR		NR	
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR	NR	>25-50[b]	NR		NR	
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR	NR	NR	NR		NR	
Dermal Contact	NR	NR	NR	NR	10	16	1-9	0.5-76	1		NR	
Deodorant (underarm)	NR	NR	NR	NR	1[b]	NR	NR	3	NR		NR	
Hair - Non-Coloring	NR	NR	NR	NR	NR	NR	NR	6-8	NR		NR	
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR	NR		NR	
Nail	NR	NR	NR	NR	NR	NR	0.9	10	NR		NR	
Mucous Membrane	NR	NR	2	NR	NR	NR	16	87	NR		NR	
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR	NR		NR	

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses	Max Conc of Use (%)	# of Uses	Max Conc of Use (%)	# of Uses		Max Conc of Use (%)	
	Isostearyl Behenate		**Isostearyl Hydroxystearate**		**Isostearyl Isononanoate**			
	2013[25]	**2012[26]**			**2013[25]**	**2009[19]**	**2012[26]**	**2009[19]**
Totals*	**7**	**4**	**2013[25]**	**2012[26]**	**4**	**NR**	**NR**	**NR**
Duration of Use			**22**	**0.01-3**				
Leave-On	*7*	*4*			*3*	*NR*	*NR*	*NR*
Rinse-Off	*NR*	*NR*	*22*	*0.01-3*	*1*	*NR*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type				*NR*	*NR*			
Eye Area	NR	NR			NR	NR	NR	NR
Incidental Ingestion	NR	NR	8	3	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	7	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR	NR	NR
Dermal Contact	7	4	3	0.01	NR	NR	NR	NR
Deodorant (underarm)	NR	NR	15	0.01-3	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	4	NR	NR	NR
Mucous Membrane	NR	NR	NR	NR	NR	NR	NR	NR
Baby Products	NR	NR	7	NR	NR	NR	NR	NR

	Isostearyl Isostearate		**Isostearyl Laurate**		NR	N
	2013[25]	**2012[26]**	**2013[25]**	**2012[26]**	**2013[25]**	**2012[26]**
Totals*	**207**	**1-31**	**NR**	**0.4**	**2**	**2-3**
Duration of Use						
Leave-On	*193*	*1-31*	*NR*	*NR*	*2*	*2-3*
Rinse-Off	*13*	*NR*	*NR*	*0.4*	*NR*	*NR*
Diluted for (Bath) Use	*1*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type						
Eye Area	5	4	NR	NR	NR	NR
Incidental Ingestion	115	4-31	NR	NR	NR	2
Incidental Inhalation-Spray	1	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	1	NR
Dermal Contact	92	1-30	NR	0.4	2	2-3
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	115	4-31	NR	NR	NR	2
Baby Products	NR	NR	NR	NR	NR	NR

	Isostearyl Myristate				**Isostearyl Neopentanoate**				**Isostearyl Palmitate**	
	2013[25]	**2007[16]**	**2012[90]**	**2012[26]**	**2013[25]**	**2002[6]**	**2012[26]**	**1981[12] 2003[6]**	**2013[25]**	**2012[26]**
Totals	**1**	**NR**	**2**	**NR**	**223**	**71**	**0.5-46**	**0.2-50**	**54**	**0.2-17**
Duration of Use										
Leave-On	*1*	*NR*	*2*	*NR*	*208*	*66*	*0.5-46*	*0.2-50*	*46*	*0.2-17*
Rinse Off	*NR*	*NR*	*NR*	*NR*	*15*	*4*	*5-16*	*>5-25*	*8*	*0.5-8*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type										
Eye Area	NR	NR	NR	NR	78	7	3-30	1-25	7	0.2-5
Incidental Ingestion	NR	NR	NR	NR	8	3	4-19	9-14	4	5-8
Incidental Inhalation-Spray	NR	NR	NR	NR	4[a]	6[a,b]	0.5 (pump spray)	2-4[a]	4[a]	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	31	3	1-16	3-6	9	1-16
Dermal Contact	1	NR	2	NR	201	68	0.5-46	0.2-50	42	0.2-17
Deodorant (underarm)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	13	NR	16	NR	8	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	1	NR	NR	NR	NR	1
Mucous Membrane	NR	NR	NR	NR	8	3	4-19	9-14	4	0.5-8
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses		Max Conc of Use (%)		# of Uses	Max Conc of Use (%)	# of Uses	Max Conc of Use (%)
	Isotridecyl Isononanoate				Isotridecyl Stearate		Lauryl Laurate	
	2013[25]	2009[19]	2012[26]	2009[19]	2013[25]	2012[26]	2013[25]	2012[26]
Totals*	**81**	**62**	**1-21**	**0.7-51**	**1**	**NR**	**35**	**0.1-16**
Duration of Use								
Leave-On	*81*	*62*	*1-21*	*0.7-51*	*1*	*NR*	*35*	*0.1-16*
Rinse-Off	*NR*	*NR*	*3-4*	*NR*	*NR*	*NR*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type								
Eye Area	4	NR	2-21	0.7	1	NR	2	0.8-16
Incidental Ingestion	18	19	2	10	NR	NR	2	NR
Incidental Inhalation-Spray	3[a]	NR	NR	0.8[a]	NR	NR	3	NR
Incidental Inhalation-Powder	6	6	2	10	NR	NR	NR	0.1
Dermal Contact	63	43	1-21	0.7-51	1	NR	32	0.1-16
Deodorant (underarm)	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	3	3	NR	NR	1	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR	1	NR
Mucous Membrane	18	19	2	10	NR	NR	2	NR
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR

	Lauryl Palmitate		Myristyl Laurate		Myristyl Myristate			
	2013[25]	2012[26]	2013[25]	2012[26]	2013[25]	2007[16]	2012[26]	2008[16]
Totals*	**2**	**NR**	**13**	**0.1-2**	**426**	**304**	**0.5-17**	**0.3-17**
Duration of Use								
Leave-On	*1*	*NR*	*12*	*0.2-2*	*385*	*271*	*0.5-17*	*0.4-17*
Rinse-Off	*1*	*NR*	*1*	*0.1-0.7*	*37*	*28*	*0.5-4*	*0.3-2*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*4*	*5*	*1-2*	*NR*
Exposure Type								
Eye Area	NR	NR	2	0.4-2	62	34	1-12	0.4-13
Incidental Ingestion	NR	NR	1	2	30	18	1-12	6-9
Incidental Inhalation-Spray	NR	NR	NR	0.2[a]	15[a]	9[a,b]	0.5-0.8[a]; 2-17	2-17[a,b]
Incidental Inhalation-Powder	NR	NR	NR	NR	4	NR	2-5	NR
Dermal Contact	1	NR	12	0.1-2	377	269	0.5-17	0.3-17
Deodorant (underarm)	NR	NR	NR	NR	14[b]	6[b]	2 (not a spray)	2[b]
Hair - Non-Coloring	1	NR	NR	0.4-0.5	18	13	0.5-8	2
Hair-Coloring	NR	NR	NR	NR	NR	NR	1	NR
Nail	NR	NR	NR	NR	1	4	1-7	2-3
Mucous Membrane	NR	NR	1	2	35	23	1-12	3-9
Baby Products	NR	NR	NR	NR	2	15	2-3	1-2

	Myristyl Neopentanoate		Myristyl Stearate				Octyldodecyl Erucate	
	2013[25]	2012[26]	2013[25]	2002[5]	2012[26]	1985[11]/ 2003[5]	2013[25]	2012[26]
Totals*	**NR**	**2**	**2**	**NR**	**NR**	**>1-5**	**1**	**0.01-10**
Duration of Use								
Leave-On	*NR*	*2*	*2*	*NR*	*NR*	*>1-5*	*1*	*0.01-10*
Rinse-Off	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*0.01-0.1*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type								
Eye Area	NR	2	NR	NR	NR	NR	NR	0.01-0.2
Incidental Ingestion	NR	NR	NR	NR	NR	NR	NR	10
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR	NR	0.1
Dermal Contact	NR	2	2	NR	NR	>1-5	1	0.1-1
Deodorant (underarm)	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	4	NR	0.01
Mucous Membrane	NR	NR	NR	NR	NR	NR	NR	10
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses	Max Conc of Use (%)	# of Uses	Max Conc of Use (%)	# of Uses		Max Conc of Use (%)	
	Octyldodecyl Hydroxystearate		**Octyldodecyl Isostearate**		**Octyldodecyl Myristate**			
			2013[25]	**2012[26]**	**2013[25]**	**2007[16]**	**2012[26]**	**2008[16]**
Totals*	**2013[25]**	**2012[26]**	**NR**	**2**	**160**	**95**	**0.05-32**	**0.007-21**
Duration of Use	**1**	**NR**						
Leave-On			*NR*	*2*	*148*	*88*	*0.05-32*	*0.07-21*
Rinse-Off	*1*	*NR*	*NR*	*NR*	*12*	*7*	*0.4-3*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type	*NR*	*NR*						
Eye Area			NR	2	14	7	0.05-2	0.3-2
Incidental Ingestion	1	NR	NR	NR	19	10	0.08-21	0.07-21
Incidental Inhalation-Spray	NR	NR	NR	NR	13[a]	7[a]	NR	1[a]
Incidental Inhalation-Powder	NR	NR	NR	NR	3	2	NR	NR
Dermal Contact	NR	NR	NR	2	137	83	0.05-32	0.007-12
Deodorant (underarm)	1	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	2	1	3	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	NR	NR	19	10	0.08-21	0.07-21
Baby Products	NR	NR	NR	NR	2	2	NR	NR

	Octyldodecyl Neopentanoate		**Octyldodecyl Octyldodecanoate**		**Octyldodecyl Olivate**	
	2013[25]	**2012[26]**	**2013[25]**	**2012[26]**	**2013[25]**	**2012[26]**
Totals	**124**	**0.5-20**	**1**	**4**	**11**	**2**
Duration of Use						
Leave-On	*114*	*0.5-20*	*1*	*4*	*11*	*2*
Rinse Off	*10*	*3*	*NR*	*NR*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type						
Eye Area	20	1-9	NR	NR	2	NR
Incidental Ingestion	30	0.7-12	NR	NR	NR	NR
Incidental Inhalation-Spray	7[a]	7[a] 20 (pump spray)	NR	NR	NR	NR
Incidental Inhalation-Powder	2	2-4	NR	NR	NR	NR
Dermal Contact	84	0.8-20	1	4	11	2
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	10	0.5	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	30	0.7-12	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR

	Octyldodecyl Ricinoleate				**Octyldodecyl Stearate**		**Oleyl Erucate**	
	2013[25]	**2002[20]**	**2012[26]**	**2004[20]**	**2013[25]**	**2012[26]**	**2013[25]**	**2012[26]**
Totals	**10**	**NR**	**0.9-3**	**3-5**	**42**	**3-19**	**44**	**1-12**
Duration of Use								
Leave-On	*5*	*NR*	*0.9-3*	*3-5*	*42*	*3-19*	*40*	*1-12*
Rinse Off	*5*	*NR*	*NR*	*NR*	*NR*	*NR*	*4*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type								
Eye Area	NR	NR	NR	NR	32	4-19	1	12
Incidental Ingestion	NR	NR	0.9-3	3-5	2	9	14	NR
Incidental Inhalation-Spray	NR	NR	NR	3[a]	NR	NR	12[a]	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	1	NR	NR	11
Dermal Contact	2	NR	3	3	40	3-19	29	1-12
Deodorant (underarm)	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	8	NR	NR	NR	NR	NR	1	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	0.9-3	3-5	2	9	15	NR
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses	Max Conc of Use (%)	# of Uses	Max Conc of Use (%)	# of Uses	Max Conc of Use (%)
	Oleyl Linoleate		**Oleyl Oleate**		**Propylheptyl Caprylate**	
	2013[25]	**2012[26]**	**2013[25]**	**2012[26]**	**2013[25]**	**2012[26]**
Totals	**NR**	**10-11**	**10**	**0.4-9**	**47**	**1-13**
Duration of Use						
Leave-On	*NR*	*10-11*	*9*	*0.4-9*	*46*	*2-13*
Rinse Off	*NR*	*10*	*1*	*1*	*1*	*1*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type						
Eye Area	NR	NR	3	NR	16	NR
Incidental Ingestion	NR	10	3	9	13	13
Incidental Inhalation-Spray	NR	NR	NR	NR	2[a]	5
Incidental Inhalation-Powder	NR	NR	3	NR	NR	NR
Dermal Contact	NR	10	7	0.4-3	33	2-6
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	1	1
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	11	3	9	13	13
Baby Products	NR	NR	NR	NR	NR	NR

	Stearyl Beeswax		**Stearyl Behenate**				**Stearyl Caprylate**			
	2013[25]	**2012[26]**	**2013[25]**	**2010[18]**	**2012[26]**	**2010[18]**	**2013[25]**	**2010[18]**	**2012[26]**	**2010[18]**
Totals	**10**	**0.4**	**NR**	**NR**	**NR**	**0.02**	**29**	**20**	**0.3-5**	**0.1-1**
Duration of Use										
Leave-On	*9*	*0.4*	*NR*	*NR*	*NR*	*0.02*	*28*	*19*	*0.3-5*	*0.3-1*
Rinse Off	*1*	*NR*	*NR*	*NR*	*NR*	*NR*	*1*	*1*	*NR*	*0.1-0.6*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type										
Eye Area	NR	0.4	NR	NR	NR	0.02	5	2	0.3-1	≤1
Incidental Ingestion	NR	NR	NR	NR	NR	NR	2	2	0.5	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR	NR	NR	0.5[a]	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dermal Contact	10	0.4	NR	NR	NR	NR	27	20	0.3-5	≤1
Deodorant (underarm)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	NR	NR	NR	NR	3	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	NR	NR	NR	NR	3	3	0.5	NR
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

	Stearyl Heptanoate				**Stearyl Olivate**				**Stearyl Palmitate**			
	2013[25]	**2010[18]**	**2012[26]**	**1993[3]/ 2010[18]**	**2013[25]**	**2010[18]**	**2012[26]**	**2010[18]**	**2013[25]**	**2010[18]**	**2012[26]**	**2010[18]**
Totals	**99**	**102**	**0.6-11**	**0.07-25**	**3**	**1**	**NR**	**NR**	**NR**	**NR**	**0.02-0.6**	**3**
Duration of Use												
Leave-On	*95*	*99*	*0.6-11*	*0.07-25*	*1*	*NR*	*NR*	*NR*	*NR*	*NR*	*0.02-0.6*	*3*
Rinse Off	*4*	*3*	*2-7*	*0.7-3*	*2*	*1*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type												
Eye Area	19	NR	0.6-11	0.5-8	NR	NR	NR	NR	NR	NR	0.02-0.6	3
Incidental Ingestion	11	8	2-11	5-25	NR	NR	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	1	1	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	2	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dermal Contact	86	92	0.6-11	0.07-25	3	1	NR	NR	NR	NR	NR	NR
Deodorant (underarm)	NR	NR	NR	0.07[b]	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	2	2	2-3	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Mucous Membrane	14	8	2-11	5-25	1	NR	NR	NR	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

Table 8. Frequency and concentration of use (historical and current) according to duration and type of exposure

	# of Uses		*Max Conc of Use (%)*		*# of Uses*	*Max Conc of Use (%)*	*# of Uses*		*Max Conc of Use (%)*	
	Stearyl Stearate				**Tetradecyloctadecyl Stearate**		**Tridecyl Isononanoate**			
	2013[25]	**2010[18]**	**2012[26]**	**2010[18]**	**2013[25]**	**2012[26]**	**2013[25]**	**2009[19]**	**2012[26]**	**2009[19]**
Totals	**27**	**22**	**0.02-3**	**0.02-4**	**2**	**NR**	**1**	**1**	**NR**	**9**
Duration of Use										
Leave-On	*25*	*20*	*0.02-3*	*0.02-4*	*2*	*NR*	*1*	*1*	*NR*	*9*
Rinse Off	*2*	*2*	*2*	*2*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Diluted for (Bath) Use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure Type										
Eye Area	6	5	0.2	≤1	NR	NR	NR	NR	NR	NR
Incidental Ingestion	5	5	0.3-0.9	≤1	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	2	1	NR	NR	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Dermal Contact	15	16	0.02-2	≤4	2	NR	1	1	NR	9
Deodorant (underarm)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	2	1	3	3	NR	NR	NR	NR	NR	NR
Hair-Coloring	NR	NR	2	NR	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Mucous Membrane	7	7	0.3-2	≤2	NR	NR	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

	Tridecyl Neopentanoate		**Tridecyl Stearate**	
	2013[25]	**2012[26]**	**2013[25]**	**2012[26]**
Totals	**16**	**2-41**	**88**	**0.2-18**
Duration of Use				
Leave-On	*15*	*2-41*	*74*	*0.2-16*
Rinse Off	*1*	*5*	*13*	*2-18*
Diluted for (Bath) Use	*NR*	*NR*	*1*	*NR*
Exposure Type				
Eye Area	10	5-41	NR	0.3
Incidental Ingestion	1	2.5	11	3-16
Incidental Inhalation-Spray	NR	NR	1[a]	2 0.4 (pump spray)
Incidental Inhalation-Powder	NR	5	1	NR
Dermal Contact	15	2-41	69	0.2-18
Deodorant (underarm)	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	87	0.4-7
Hair-Coloring	NR	NR	NR	NR
Nail	NR	NR	NR	NR
Mucous Membrane	1	2-5	11	3-16
Baby Products	NR	NR	1	NR

*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.
#Prior to 2012, concentration of use surveys did not request specific information about whether or not products are sprays.
[a]Includes suntan products, and it is not known whether the reported product is a spray.
[b]It is not known whether or not the product is a spray.
[c]Product categories generic, giving no indication of duration of use or exposure type.
NR – no reported uses
NS – not specified

Table 9. Ingredients not reported to be in current use[26-28,91]

Arachidyl Erucate	Decyl Myristate	Isopropyl Behenate
Batyl Isostearate	Decyl Palmitate	Isopropyl Laurate
Batyl Stearate	Decyltetradecyl Cetearate	Isopropyl Oleate
Behenyl Isostearate	Ethylhexyl Adipate/Palmitate/Stearate	Isopropyl Tallowate
Behenyl/Isostearyl Beeswax	Ethylhexyl C10-40 Isoalkyl Acidate	Isostearyl Erucate
Butyl Babassuate	Ethylhexyl Neopentanoate	Isotridecyl Laurate
Butyl Isostearate	Ethylhexyl Oleate	Isotridecyl Myristate
Butyl Oleate	Erucyl Arachidate	Lauryl Behenate
Butyloctyl Beeswax	Erucyl Erucate	Lauryl Cocoate
Butyloctyl Behenate	Erucyl Oleate	Lauryl Isostearate
Butyloctyl Candelillate	Hexyldecyl Hexyldecanoate	Lauryl Myristate
Butyloctyl Cetearate	Hexyldecyl Oleate	Lauryl Oleate
Butyloctyl Oleate	Hexyldecyl Palmitate	Lauryl Stearate
Butyloctyl Palmitate	Hexyldodecyl/Octyldecyl Hydroxystearate	Lignoceryl Erucate
C14-30 Alkyl Beeswax	Hydrogenated Castor Oil Behenyl Esters	Myristyl Isostearate
C18-38 Alkyl Beeswax	Hydrogenated Castor Oil Cetyl Esters	Octyldecyl Oleate
C30-50 Alkyl Beeswax	Hydrogenated Castor Oil Stearyl Esters	Octyldodecyl Avocadoate
C20-40 Alkyl Behenate	Hydrogenated Ethylhexyl Sesamate	Octyldodecyl Beeswax
C18-38 Alkyl C24-54 Acid Ester	Hydrogenated Isocetyl Olivate	Octyldodecyl Behenate
C16-36 Alkyl Stearate	Hydrogenated Isopropyl Jojobate	Octyldodecyl Cocoate
C30-50 Alkyl Stearate	Hydroxycetyl Isostearate	Octyldodecyl Hydroxystearate
C40-60 Alkyl Stearate	Isobutyl Myristate	Octyldodecyl Meadowfoamate
Caprylyl Butyrate	Isobutyl Palmitate	Octyldodecyl Neodecanoate
Cetearyl Nonanoate	Isobutyl Pelargonate	Octyldodecyl Oleate
Cetearyl Palmate	Isobutyl Stearate	Octyldodecyl Safflowerate
Cetearyl Palmitate	Isobutyl Tallowate	Oleyl Arachidate
Cetearyl Rice Branate	Isocetyl Isodecanoate	Oleyl Myristate
Cetyl Behenate	Isocetyl Isostearate	Oleyl Stearate
Cetyl Dimethyloctanoate	Isocetyl Laurate	Stearyl Behenate
Cetyl Isononanoate	Isodecyl Hydroxystearate	Stearyl Erucate
Cetyl Myristoleate	Isodecyl Palmitate	Stearyl Linoleate
Cetyl Oleate	Isodecyl Stearate	Tetradecyleicosyl Stearate
Chimyl Isostearate	Isohexyl Laurate	Tetradecyloctadecyl Behenate
Chimyl Stearate	Isohexyl Neopentanoate	Tetradecyloctadecyl Hexyldecanoate
C10-40 Isoalkyl Acid Octyldodecanol Esters	Isohexyl Palmitate	Tetradecyloctadecyl Myristate
C4-5 Isoalkyl Cocoate	Isolauryl Behenate	Tetradecylpropionates
C32-36 Isoalkyl Stearate	Isooctyl Caprylate/Caprate	Tridecyl Behenate
Coco-Rapeseedate	Isooctyl Tallate	Tridecyl Cocoate
Decyl Castorate	Isopropyl Arachidate	Tridecyl Erucate
Decyl Isostearate	Isopropyl Avocadate	Tridecyl Laurate
Decyl Jojobate	Isopropyl Babassuate	Tridecyl Myristate
Decyl Laurate		

Table 10. Examples of non-cosmetic uses

Ingredient	Non-Cosmetic Use	Reference
Behenyl Behenate	used in mold releasing agents in methyl acrylamide polymer	[74]
Butyl Oleate	indirect food additive as a plasticizer in rubber articles biodiesel additive; polyvinylchloride plasticizer; water-resisting agent; in hydraulic fluids	21CFR177.2600 [92]
Ethylhexyl Laurate	lubricant for friction and in paper industry; activity enhancer for pesticides	[75]
Isoamyl Laurate	direct food additive as a synthetic flavoring substance and adjuvant	21CFR172.515
Isobutyl Palmitate	indirect food additive used in fiber finishing or in textile fibers	21CFR177.2260; 21CFR177.2800
Isooctyl Tallate	indirect food additive as a plasticizer in rubber articles	21CFR177.2600
Isopropyl Laurate	indirect food additive as a lubricant in the manufacture of metallic articles; use level not to exceed 10% by wt.	21CFR178.3910
Isopropyl Oleate	indirect food additive as a lubricant in the manufacture of metallic articles or in mineral oil lubricants with incidental food contact	21CFR178.3910; 21CFR178.3570

Table 11. Irritation and sensitization studies

Test Article	Concentration/Dose	Test Population	Procedure	Results	Reference
DERMAL IRRITATION					
NON-HUMAN					
Propylheptyl Caprylate					
propylheptyl caprylate	applied neat; amount applied was not specified	SPF albino rabbits, 3 females	4-h semi-occlusive patch; mean scores were calculated on the bases of 24, 48, and 72-h scores, with a maximum value of 3	moderately irritating erythema: scores were 2, 2, and 2.33 edema: scores were 0.33, 1, and 0	44
Isopropyl Palmitate					
cream formulation consisting of 10% isopropyl palmitate, carbomers, sorbitan oleate, paraffin liquid, propylene glycol, trometamol, and purified water	5 mg cream/cm^2 applied 2x/day	hairless guinea pigs, 15 males	tolerance test; open applications were made on each side of the dorsal trunk for 4 days; test sites were scored immediately prior to each application and at the end of the study on scale of 0-4 for erythema and 0-3 for both scaling and fissures for a total possible score of 10 cream without isopropyl palmitate served as the negative vehicle control; cream consisting of glyceryl stearate, PEG-100 stearate, cetostearyl alcohol, paraffin oil, propylene glycol, citric acid monohydrate, sodium citrate was used as a positive vehicle control	cream with 10% isopropyl palmitate, but not without it, caused a moderate degree of irritation the clinical scores as assessed by the AUC (given as the mean; study days were plotted on the x-axis and average clinical score on the y-axis) were 1.10, 7.25, and 9.10 for the negative control, the cream containing isopropyl palmitate, and the positive control, respectively	38
Ethylhexyl Laurate					
ethylhexyl laurate	0.5 g	rabbits, number not specified	OECD Guideline 404 for "acute dermal irritation/corrosion" testing: a semi-occlusive patch is applied to an approximately 6 cm^2area for 4 h; erythema and edema are each scored on a scale of 0-4	slightly irritating using OECD guidelines non-irritating according to the EC classification	45
Isodecyl Laurate					
isodecyl laurate	30 in liquid paraffin 500 mg/dose	unclear whether rats or rabbits were used	applications were made to two 4 cm x 4 cm intact and abraded test sites; details were not provided	not irritating	46
HUMAN					
Propylheptyl Caprylate					
propylheptyl caprylate	undiluted and 10, 25, or 50% in mineral oil 47.6 mg/cm^2	22 subjects	single 48-h occlusive application ; approximately 0.2 ml of each test material was applied using a 1.9 cm x 1.9 cm patch	no dermal effects at any concentration	44
Isopropyl Myristate					
isopropyl myristate	not specified	244 subjects with contact dermatitis	patch testing occurred over a 3-yr period with a series of test materials (details were not provided)	three positive responses to isopropyl myristate	47
Isopropyl Palmitate					
cream containing 10% isopropyl palmitate (described earlier)	0.1 ml	20 subjects	human chamber scarification test; occlusive 23-h patch; test material was applied to the abraded skin of the volar forearm daily for 3 days paraffin oil was applied as the negative control and 0.5% aq. SLS was used as the positive control; positive and negative vehicle control creams (described previously) were also tested irritation was scored on a scale of 0-4 immediately prior to patch application and 1 h after removal of the final patch	the test material was well-tolerated clinical scores for the test material (2.71), the positive vehicle control (2.51), and the negative vehicle control (2.39) as assessed by AUC (given as the geomean; study days were plotted on the x-axis and average clinical score on the y-axis) were greater than that of the negative control (2.17), but the differences were not statistically significant clinical score of the positive control was 5.29	38

Table 11. Irritation and sensitization studies

Test Article	Concentration/Dose	Test Population	Procedure	Results	Reference
			Ethylhexyl Laurate		
2-ethylhexyl esters of C8-14 fatty acids	50% and undiluted	10 subjects	open epicutaneous test; test substance was applied for 60 min (additional details were not provided.)	not irritating at either concentration	[45]
2-ethylhexyl esters of C8-14 fatty acids	25, 50,and 100%	20 subjects	closed epicutaneous test; applied for 24 h under an occlusive patch (additional details were not provided.)	25 and 50%: no reactions observed 100%: slight erythema, 3 incidences of moderate edema, and 1 of slight edema were observed	[45]
DERMAL SENSITIZATION					
NON-HUMAN					
			Propylheptyl Caprylate		
propylheptyl caprylate	0, 2, 10, and 50% in corn oil	mouse	LLNA	not a sensitizer a lymphocyte proliferative response was not induced	[44]
			Ethylhexyl Laurate		
ethylhexyl laurate	intradermal induction: 0.5% topical induction: 40% challenge: 20%	guinea pigs	GPMT (details were not provided)	not a sensitizer	[45]
			Isodecyl Laurate		
isodecyl laurate	not specified	guinea pigs	GPMT (details were not provided)	not a sensitizer	[46]
HUMAN					
			Butyl Oleate		
butyl oleate	not specified	25 subjects; 9 male and 16 female	maximization study; an occlusive patch was applied to the volar forearm of all subjects for 5 alternate-day 48-h periods an occlusive patch wit h 5% SLS was applied prior to patching sites were scored upon patch removal and 24 h later	not a sensitizer all challenge scores were 0	[48]
			Ethylhexyl Palmitate		
body oil containing 77.9% ethylhexyl palmitate	applied neat	104 subjects	modified HRIPT; 24-h semi-occlusive patches with 150 µl of test material induction: 2 cm x 2 cm Webril pad was applied for 24-h, 3x/wk for 3 wks; sites were graded 24 or 48 h after patch removal challenge: after a 1-wk non-treatment period, two concurrent 24-h challenge patches were applied, one to the induction site and one to a previously untreated area on the back; these sites were graded immediately upon and 24 h after patch removal	not an irritant or a sensitizer no reactions were observed during induction or challenge	[49]
			Ethylhexyl Stearate		
lip gloss formulation containing 25.9% ethylhexyl stearate	applied neat	104 subjects	modified HRIPT; 24-h semi-occlusive patches with 150 mg of test material induction: 2 cm x 2 cm Webril pad was applied for 24-h, 3x/wk for 3 wks; sites were graded 24 or 48 h after patch removal challenge: after a 1-wk non-treatment period, two concurrent 24-h challenge patches were applied, one to the induction site and one to a previously untreated area on the back; these sites were graded immediately upon and 24 h after patch removal	not an irritant or a sensitizer no reactions were observed during induction or challenge	[50]

Table 11. Irritation and sensitization studies

Test Article	Concentration/Dose	Test Population	Procedure	Results	Reference
eyebrow pencil formulation containing 38.8% ethylhexyl stearate	applied neat	642 subjects	HRIPT; 24-h semi-occlusive patches induction: patches applied 3x/wk for 3 wks; sites were graded for irritation 24 or 48 h after patch removal challenge: after a 2-wk non-treatment period, a 24-h challenge patch was applied to a previously untreated area on the back; this site was graded upon patch removal and at 48 and 72 h	not an irritant or a sensitizer no reactions were observed during induction or challenge	[51]
			Isocetyl Myristate		
concealer formulation containing 29.5% isocetyl myristate	applied neat	104 subjects	HRIPT; 24-h semi-occlusive patches; 0.2 g test material induction: 1" x 1" absorbent pad with clear adhesive dressing was applied 3x/wk for 3 wks; sites were graded for irritation 24 or 48 h after patch removal challenge: after a 2-wk non-treatment period, a 24-h challenge patch was applied to a previously untreated area on the back; this site was graded upon patch removal and at 72 h	not an irritant or a sensitizer no reactions were observed during induction or challenge	[52]
			Cetyl Ricinoleate		
lipstick formulation containing 15.2% cetyl ricinoleate	applied neat	621 subjects	HRIPT;24-h semi-occlusive patches induction: patches applied 3x/wk for 3 wks; sites were graded for irritation 24 or 48 h after patch removal challenge: after a 2-wk non-treatment period, a 24-h challenge patch was applied to a previously untreated area on the back; this site was graded upon patch removal and at 48 and 72 h	not an irritant or a sensitizer no reactions were observed during induction or challenge	[53]

Abbreviations: AUC = area under the curve; EC = European Commission; GPMT – guinea pig maximization test; HRIPT = human repeated insult patch test; LLNA = local lymph node assay; OECD = Organisation for Economic Co-operation and Development; SLS = sodium lauryl sulfate

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