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Amended Safety Assessment of Dialkyl Dimer Dilinoleates as Used in Cosmetics

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Abstract

The Expert Panel for Cosmetic Ingredient Safety (Panel) reassessed the safety of 8 dialkyl dimer dilinoleates as used in cosmetics. These ingredients are diesters formed from the reaction of straight-chained or branched alkyl alcohols and dilinoleic acid; these ingredients are reported to function in cosmetics as skin-conditioning agents. The Panel reviewed data relevant to the safety of these ingredients and concluded that Diisopropyl Dimer Dilinoleate, Dicetearyl Dimer Dilinoleate, Diisostearyl Dimer Dilinoleate, Diethylhexyl Dimer Dilinoleate, Dioctyldodecyl Dimer Dilinoleate, Ditridecyl Dimer Dilinoleate, Di-C16-18 Alkyl Dimer Dilinoleate, and Di-C20-40 Alkyl Dimer Dilinoleate are safe in cosmetics in the present practices of use and concentration described in this safety assessment.

Keywords

diisopropyl dimer dilinoleate, safety, cosmetics, personal care products, risk assessment

Introduction

The safety of 6 of the 8 cosmetic ingredients named in this safety assessment has been previously reviewed by the Panel; in 2003, the Panel published a final report with a conclusion stating that Diisopropyl Dimer Dilinoleate, Dicetearyl Dimer Dilinoleate, Diisostearyl Dimer Dilinoleate, Diethylhexyl Dimer Dilinoleate (at the time named Dioctyl Dimer Dilinoleate), Dioctyldodecyl Dimer Dilinoleate and Ditridecyl Dimer Dilinoleate were safe as used in cosmetic formulations.[1] In accordance with its Procedures, the Panel evaluates the conclusions of previously-issued reports every 15 years, and therefore a re-review was initiated.

In addition to the six dialkyl dimer dilinoleates mentioned above, this re-review included 2 related, previously unreviewed ingredients. The complete list of ingredients included in this assessment is:

Diisopropyl Dimer Dilinoleate
Dicetearyl Dimer Dilinoleate
Diisostearyl Dimer Dilinoleate
Diethylhexyl Dimer Dilinoleate
Dioctyldodecyl Dimer Dilinoleate
Ditridecyl Dimer Dilinoleate
Di-C16-18 Alkyl Dimer Dilinoleate
Di-C20-40 Alkyl Dimer Dilinoleate
Previously reviewed ingredients are indicated in italics.

According to the web-based *International Cosmetic Ingredient Dictionary and Handbook* (wINCI; *Dictionary*), the ingredients named above are reported to function as skin-conditioning agents.[2] Definitions, idealized structures, and functions of these ingredients can be seen in Table 1. In addition to being reported as a skin-conditioning agent, Di-C20-40 Alkyl Dimer Dilinoleate is also reported to function as a viscosity-increasing agent-non-aqueous.

These dialkyl dimer dilinoleates are the diesters of their respective alcohols and dilinoleic acid. Table 2 presents all relevant alcohols previously reviewed by the Panel, and a list of relevant alcohols that have not yet been reviewed by the Panel can be found in Table 3.

Excerpts from the summary of the 2003 report are included throughout the text of this re-review document, as appropriate. The 2003 report contained information

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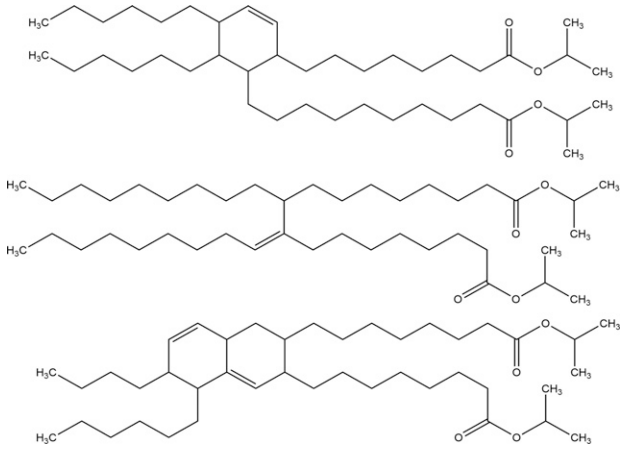
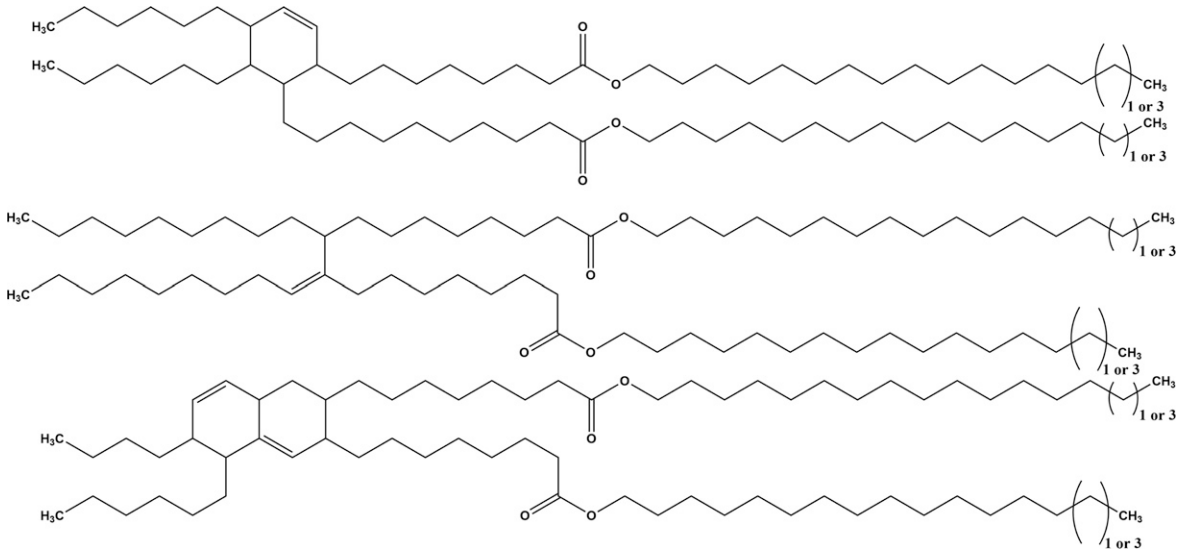
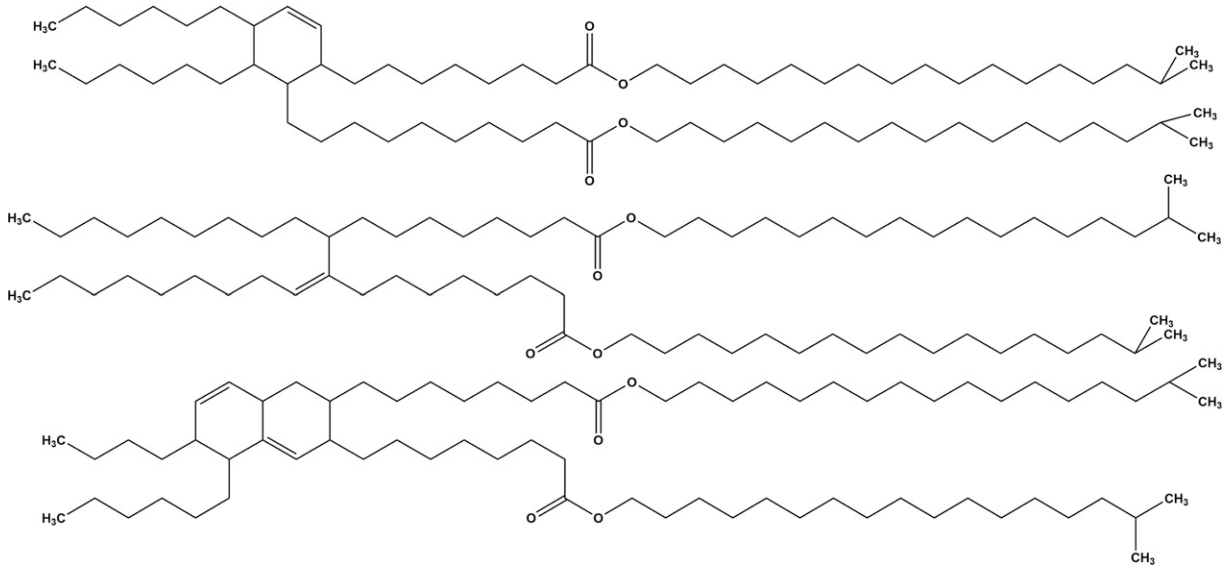
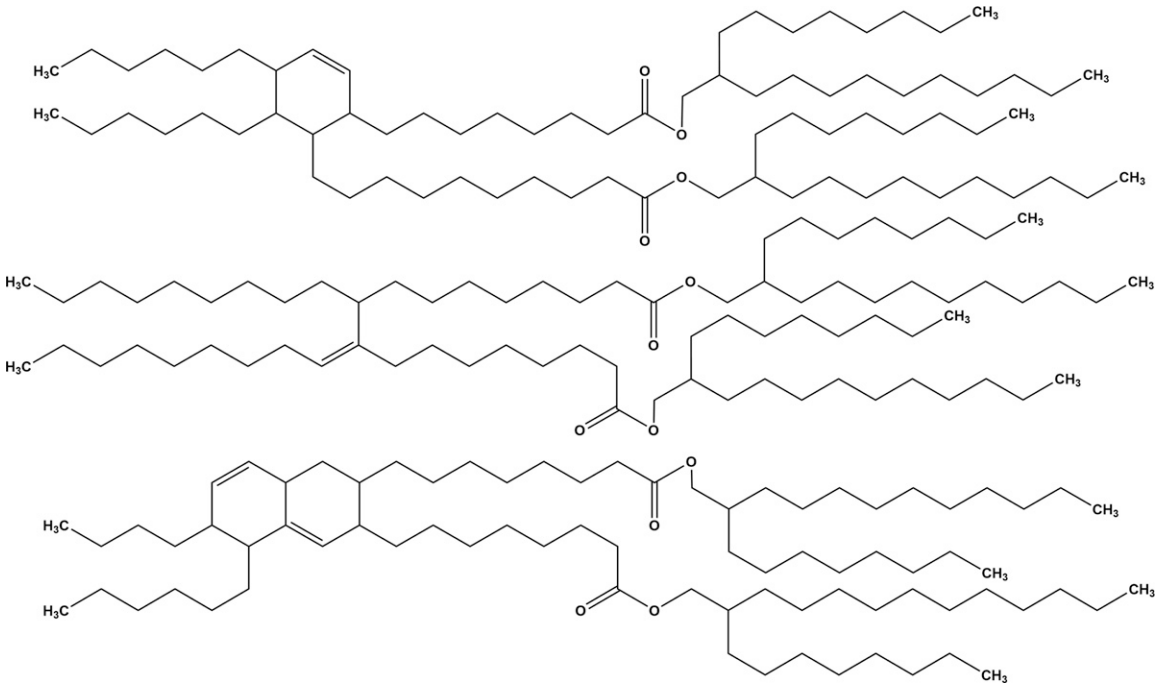
Table 1. Definitions, Idealized Structures, and Functions of the Ingredients in This Safety assessment.[2,CIR Staff]

Name & CAS No.	Definition & Structure	Function(s)
Diisopropyl Dimer Dilinoleate 205393-95-9	the diester of isopropyl alcohol and dilinoleic acid 	skin-conditioning agent—emollient
Dicetearyl Dimer Dilinoleate 135620-20-1	the diester of cetearyl alcohol and dilinoleic acid 	skin-conditioning agent—occlusive

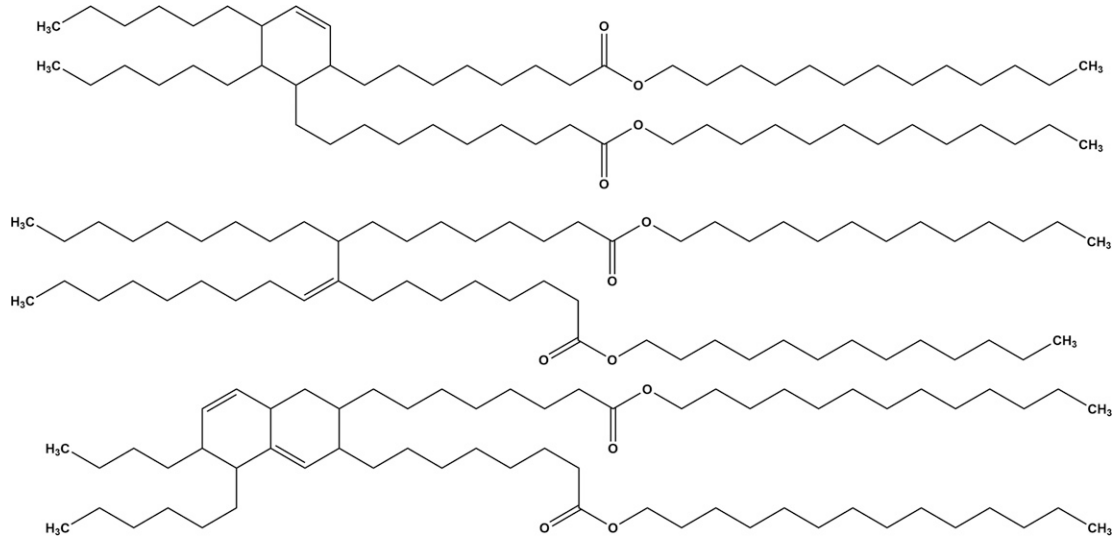
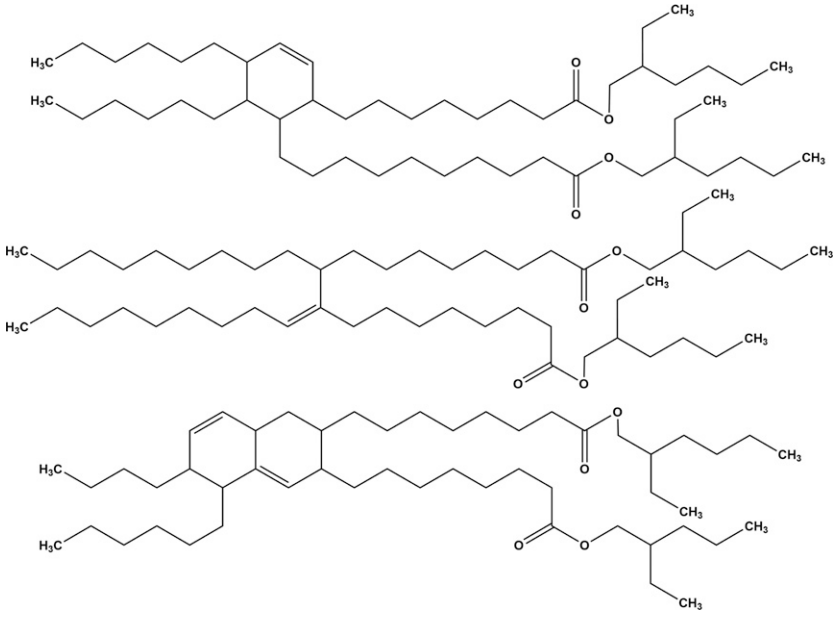
(continued)

Table 1. (continued)

Name & CAS No.	Definition & Structure	Function(s)
Diisostearyl Dimer Dilinoleate 103213-19-0	the diester of isostearyl alcohol and dilinoleic acid 	skin-conditioning agent—occlusive
Dioctyldodecyl Dimer Dilinoleate 129423-60-5	the diester of octyldodecanol and dilinoleic acid 	skin-conditioning agent—occlusive

(continued)

Table 1. (continued)

Name & CAS No.	Definition & Structure	Function(s)
Ditridecyl Dimer Dilinoleate	the diester of tridecyl alcohol and dilinoleic acid 	skin-conditioning agent—occlusive
Diethylhexyl Dimer Dilinoleate	the diester of 2-ethylhexyl alcohol and dilinoleic acid 	skin-conditioning agent—occlusive

(continued)

Table 1. (continued)

Name & CAS No.	Definition & Structure	Function(s)
Di-C16-18 Alkyl Dimer Dilinoleate 501 901-81-1	the diester of C16-18 alcohols and dilinoleic acid	skin-conditioning agent—occlusive
Di-C20-40 Alkyl Dimer Dilinoleate	the diester of C20-40 alcohols and dilinoleic acid	skin-conditioning agent—occlusive/viscosity increasing agent—non-aqueous

regarding relevant alcohols. The full reports on the alcohols can be accessed on the Cosmetic Ingredient Review (CIR) website (https://www.cir-safety.org/ingredients); therefore, information regarding these alcohols is not included in this report. The Summary of this document only includes new data.

CIR safety assessments include relevant published and unpublished data that are available for each endpoint that is evaluated. Published data are identified by conducting an exhaustive search of the world's literature. A listing of the search engines and websites that are used and the sources that are typically explored, as well as the endpoints that the Panel typically evaluates, is provided on the CIR website (https://www.cir-safety.org/supplementaldoc/preliminary-search-engines-and-websites; https://www.cir-safety.org/supplementaldoc/cir-report-format-outline). Unpublished data are provided by the cosmetics industry, as well as by other interested parties. Although an extensive search was

Table 2. Alcohol Components of Relevant Dialkyl Dimer Dilinoleates Reviewed by CIR.

Ingredient	Alcohol	Conclusion	Reference
Diisopropyl Dimer Dilinoleate	Isopropyl Alcohol	Safe as used in present practices of use	2012[3]
Dicetearyl Dimer Dilinoleate	Cetearyl Alcohol	Safe as used; this conclusion was reaffirmed in 2008	1988[4]; 2008[5]
Diisostearyl Dimer Dilinoleate	Isostearyl Alcohol	Safe as used; this conclusion was reaffirmed in 2008	1988[4]; 2008[5]
Dioctyldodecyl Dimer Dilinoleate	Octyldodecanol	Safe as used; this conclusion was reaffirmed in 2006	1985[6]; 2006[7]
Di-C16-18 Alkyl Dimer Dilinoleate	Myristyl Alcohol (C14)	Safe as used; this conclusion was reaffirmed in 2008	1988[4]; 2008[5]
Di-C16-18 Alkyl Dimer Dilinoleate	Cetyl Alcohol (C16)	Safe as used; this conclusion was reaffirmed in 2008	1988[4]; 2008[5]
Di-C16-18 Alkyl Dimer Dilinoleate	Oleyl Alcohol (C18)	Safe as used; this conclusion was reaffirmed in 2006	1985[6]; 2006[7]
Di-C16-18 Alkyl Dimer Dilinoleate	Stearyl Alcohol (C18)	Safe as used; this conclusion was reaffirmed in 2006	1985[6]; 2006[7]
Di-C20-40 Alkyl Dimer Dilinoleate	Behenyl Alcohol (C22)	Safe as used; this conclusion was reaffirmed in 2008	1988[4]; 2008[5]

conducted of the literature published since the original review, no new data were found.

Chemistry

Definition and Structure

All of the ingredients in this report are dialkyl dimer dilinoleates. Each ingredient is the diester formed from the reaction of straight-chained or branched-chain alkyl alcohols with dilinoleic acid. The precursor core, dilinoleic acid, is produced by catalytic dimerization of linoleic acid.[8]This resultant dimer is a mixture of acyclic, monocyclic, and bicyclic compounds (Figure 1). However, even these examples serve only as exemplary structures, as the degree of unsaturation in each case is variable.[9]

Esterification of this mixture of acids with an alcohol then results in a mixture of esters, the dialkyl dimer dilinoleates. For example, Diisopropyl Dimer Dilinoleate is the mixture of esters wherein the carboxylic acid functional groups are substituted with the residue of isopropyl alcohol.

Physical and Chemical Properties

The dialkyl dimer dilinoleates are clear to slightly yellow liquids or semi-solids that are isobaric mixtures of molecules with molecular weights ranging from 650 Da (diisopropyl) to nearly 1700 Da (di-C40) (Table 4).[1,6,7] These substances are very lipophilic, and therefore poorly soluble in water, but soluble in suitable oils or organic solvents.

Method of Manufacture

The dialkyl dimer dilinoleates are manufactured by an esterification process from their respective alcohols and dilinoleic acid.[1]

Impurities

Diisopropyl Dimer Dilinoleate. For Diisopropyl Dimer Dilinoleate, impurities were reported as <.1% isopropyl alcohol and <.5% dilinoleic acid (test method unavailable).[1]

Diisostearyl Dimer Dilinoleate. Impurities of Diisostearyl Dimer Dilinoleate were <1% isostearyl alcohol and <.5% dilinoleic acid.[1]

Dicetearyl Dimer Dilinoleate. Impurities of Dicetearyl Dimer Dilinoleate were anticipated to be .1%–5.0% dilinoleic acid and cetearyl alcohol.[1]

Dioctyldodecyl Dimer Dilinoleate. Dioctyldodecyl Dimer Dilinoleate impurities were anticipated to be .1%–5.0% dilinoleic acid and octyldodecanol.[1]

Ultraviolet Absorption

Dicetearyl Dimer Dilinoleate. Dicetearyl Dimer Dilinoleate, 1% in 99% hexane, did not absorb in the ultraviolet A (UVA) or UVB range.[1]

Dioctyldodecyl Dimer Dilinoleate. Dioctyldodecyl Dimer Dilinoleate, 10% in 90% hexane, did not absorb in the UVA or UVB range.[1]

Use

Cosmetic

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

Based on 2018 VCRP data and Council survey data, 2 of the 8 ingredients included in this safety assessment are currently in use.[12] The most frequently used ingredient according to 2018 VCRP data, Diisopropyl Dimer Dilinoleate, is reported to be used in 145 formulations, with a maximum

concentration of use of 29% in lipsticks[13] (Table 5). Diisostearyl Dimer Dilinoleate is reported to be used in 20 formulations, 19 of which are in leave-on products, with a maximum concentration of use of 16% in lipsticks.

Both 1998 and 2018 VCRP data reported Diisopropyl Dimer Dilinoleate as the most frequently used ingredient.[1,12] According to 1998 VCRP data, Diisopropyl Dimer Dilinoleate had the greatest frequency of use, with 35 total formulations.[1] The majority of the uses were in lipstick formulations, with concentrations as high as 53%, and in foundations with concentrations as high as 7%. In 1998, Dicetearyl Dimer Dilinoleate and Diethylhexyl Dimer Dilinoleate were reported to be in use, however, these ingredients are not reported to be in use in 2018.

Both historical and current use data are provided in Table 5. The dialkyl dimer dilinoleates not in use, according to 2018 VCRP data and Council survey data, are listed in Table 6.

None of the ingredients named in this report are restricted from use in any way under the rules governing cosmetic products in the European Union.[14]

Non-Cosmetic

Non-cosmetic uses of dialkyl dimer dilinoleates were not identified in the published literature.

Toxicokinetic Studies

No toxicokinetic studies of the dialkyl dimer dilinoleates were included in the original report, no new data were found in published literature, and unpublished data were not submitted.

Absorption, Distribution, Metabolism, and Excretion (ADME)

Dilinoleic acid, a component of each relevant ingredient, was studied. A 13-week rat feeding study suggested that dilinoleic acid, or its metabolite(s), is widely distributed through the body when ingested.[1]

Table 3. Alcohols Components of Relevant Dialkyl Dimer Dilinoleates Not Yet Reviewed by CIR.

Ingredient	Alcohol(s)
Diethylhexyl Dimer Dilinoleate	2-Ethylhexyl Alcohol
Ditridecyl Dimer Dilinoleate	Tridecyl Alcohol
Di-C20-40 Alkyl Dimer Dilinoleate	C20-40 Alcohols, Arachidyl Alcohol (C20), tetracosanol (C24), hexacosanol (C26), octacosanol (C28) Myricyl Alcohol (C30), (dotriacontanol (C32), tetratriacontanol (C34), hexatriacontanol (C36), octatriacontanol (C38), tetracontanol (C40)

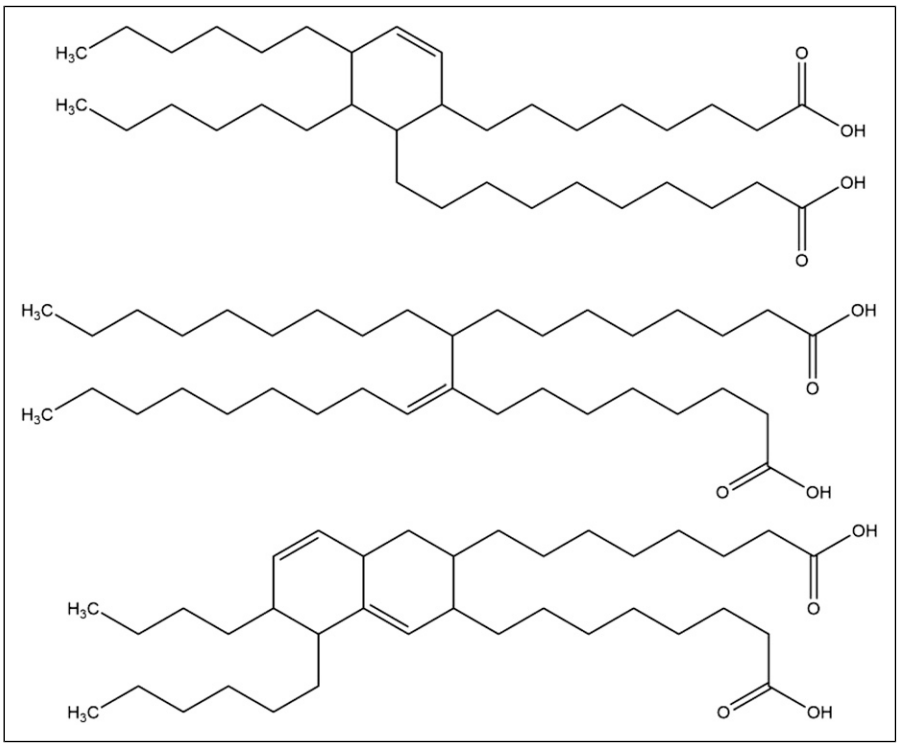


Figure 1. Examples of dilinoleic acid structures.

Table 4. Physical and Chemical Properties.

Property	Description	Reference
Diisopropyl Dimer Dilinoleate		
physical characteristics	non-oily, clear to slightly hazy yellow liquid with a mild, characteristic, fatty odor	1
molecular weight (Da)	650	1
solubility	Soluble in most organic solvents; insoluble in water and lower-molecular weight diols and triols	1
boiling point (oC)	>200	1
freezing point (oC)	−11	1
refractive index (@ 25°C)	1.4590–1.4650 1.4550–1.4655	1
specific gravity (@ 25°C)	.965 to .975	1
log P	17.79	1
Diisostearyl Dimer Dilinoleate		
physical characteristics	clear to slightly hazy yellow liquid with a characteristic odor	1
molecular weight (Da)	1078	1
solubility	soluble in most organic solvents; insoluble in water and low-molecular-weight diols and triols	1
freezing point (oC)	5	1
refractive index (@ 25°C)	1.468–1.478	1
specific gravity (@ 25°C)	.895 ± .01	1
log P	32.44 (estimated)	10
Dicetearyl Dimer Dilinoleate		
physical characteristics	yellow semi-solid with bland odor practically odorless buttery yellow solid	1
molecular weight (Da)	1013.8	11
boiling point (oC)	500	1
solubility	insoluble in water	1
log P	30.62 (estimated)	10
moisture content	.5%	1
microbial content	500 organisms per gram (opg) max; no pathogens	1
Dioctyldodecyl Dimer Dilinoleate		
physical characteristics	clear liquid with a bland odor	1
molecular weight (Da)	1126.0	11
boiling point (oC)	450	1
solubility	insoluble in water	1
log P	34.40 (estimated)	10
specific gravity (@ 25°C)	1.15	1
moisture content	.5%	1
Tridecyl Dimer Dilinoleate		1
molecular weight (Da)	929.6	11
log P	27.67 (estimated)	10
Diethylhexyl Dimer Dilinoleate		
molecular weight (Da)	789.4	11
log P	22.62 (estimated)	10
ADD-ONS		
Di-C16-18 Alkyl Dimer Dilinoleate		
molecular weight (Da)	1014–1078	11
log P	30.62–32.44 (estimated)	10
Di-C20-40 Alkyl Dimer Dilinoleate		
molecular weight (Da)	1126.0–1687.1	11
log P	34.55–54.19 (estimated)	10

Table 5. Current and Historical Frequency and Concentration of Use of Dialkyl Dimer Dilinoleates According to Duration and Exposure.

	Diisopropyl Dimer Dilinoleate				Diisostearyl Dimer Dilinoleate			
	Frequency of Use		Concentration of Use (%)		Frequency of Use		Concentration of Use (%)	
	2018[9]	1998[1]	2018[13]	1999[1]	2018[9]	1998[1]	2018	1999[1]
Totals[a]	**145**	**35**	**1-29**	**.1-53**	**20**	**20**	**5-16**	**1-12**
Duration of use								
Leave-on	*142*	*30*	*1-29*	*.05-53*	*19*	*20*	*5-16*	*1-12*
Rinse-off	*3*	*5*	*NR*	*.1-5*	*1*	*NR*	*NR*	*NR*
Diluted for (bath) use	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*	*NR*
Exposure type								
Eye area	12	2	NR	.1-3	7	11	6	5-11
Incidental ingestion	87	12	10.8-29	4-53	5	2	16	7-12
Incidental inhalation—spray	13[b]	4[b]; 4[c]	1.5-5.3[b]	9.25; 2-10[b]; 3-5[c]	4[b]	NR	NR	NR
Incidental inhalation—powder	NR	4[c]	NR	3-5[c]; 30	NR	3	NR	1-7
Dermal contact	53	22	1-5	.05-30	15	18	5-6	1-11
Deodorant (underarm)	NR	NR	NR	20[b]	NR	NR	NR	NR
Hair—non-coloring	5	1	1.5-5.3	9.25-10	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	88	12	10.8-29	4-53	6	2	16	7-12
Baby products	NR	NR	NR	NR	NR	NR	NR	NR

[a]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.
[b]Includes products that can be sprays, but it is not known whether the reported uses are sprays.
[c]Not specified whether this product is a spray or a powder or neither, but it is possible it may be a spray or a powder, so this information is captured for both categories of incidental inhalation.
NR, no reported use.

Table 6. Dialkyl Dimer Dilinoleates Not Reported to Be in Use, According to the FDA VCRP Data and Council Survey Data.

Ingredient
Dicetearyl Dimer Dilinoleate
Diethylhexyl [Dioctyl] Dimer Dilinoleate
Dioctyldodecyl Dimer Dilinoleate
Ditridecyl Dimer Dilinoleate
Di-C16-18 Alkyl Dimer Dilinoleate
Di-C20-40 Alkyl Dimer Dilinoleate

Toxicological Studies

Acute Toxicity Studies

Dermal

Dioctyldodecyl Dimer Dilinoleate. Rats were used in an acute dermal toxicity test.[1] Test substance was applied to the dorsal area and trunk at doses of 5 g/kg bw. No gross tissue or organ abnormalities were found. The acute dermal LD_{50} for Dioctyldodecyl Dimer Dilinoleate was determined to be >5 g/kg.

Oral

Diisopropyl Dimer Dilinoleate. Groups of five male and five female albino rats were used. The acute oral LD_{50} of Diisopropyl Dimer Dilinoleate was >5.0 g/kg.[1] The "limits of acute oral toxicity" of 50% of a lip gloss and a lipstick formulation, both containing 10% Diisopropyl Dimer Dilinoleate, in corn oil was >15.9 g/kg.

Diisostearyl Dimer Dilinoleate. The LD_{50} of Diisostearyl Dimer Dilinoleate was >5.0 g/kg when testing groups of five male and five female albino rats.[1] A similar study suggested the oral LD_{50} of Diisostearyl Dimer Dilinoleate was >5.0 ml/kg.

Dioctyldodecyl Dimer Dilinoleate. Five male and five female rats were dosed with 5 g/kg Dioctyldodecyl Dimer Dilinoleate.[1] None of the animals died. The oral LD_{50} for the rats was >5.0 g/kg.

Subchronic Toxicity

Dilinoleic Acid. In a 13-wk feeding study, rats were fed a maximum of 5% (w/w) dilinoleic acid via a basic purified diet, ad libitum.[1] A no-observable-adverse-effect level (NOAEL) was not found because of macrophage aggregation seen in the mesenteric lymph node at the lowest dose level (.1%).

Developmental and Reproductive Toxicity Studies

No developmental/reproductive toxicity studies were included in the original report, no new data were found in published literature, and unpublished data were not submitted.

Genotoxicity

Genotoxicity studies were not found in the published literature, and unpublished data were not submitted. However, data were included in the original safety assessment on dilinoleic acid.

An Ames test using *Salmonella typhimurium* strains TA1535, TA1537, TA100, and TA98 to test the genotoxicity of dilinoleic acid yielded negative results.[1] Chromosome aberrations were studied in human lymphocytes with and without metabolic activation at a maximum concentration of 300 μg/ml. No clastogenic effects were reported. Forward mutations were studied in mouse L5178Y lymphoma cells with and without metabolic activation. Dilinoleic acid was considered negative in the mouse lymphoma cell assay.

Carcinogenicity Studies

No carcinogenicity studies were included in the original report, no new data were found in the published literature, and unpublished data were not submitted.

Other Relevant Studies

Comedogenicity

Diisopropyl Dimer Dilinoleate. Rabbits were treated with .5 ml of a test article containing Diisopropyl Dimer Dilinoleate (concentration was not stated).[1] The researchers concluded that Diisopropyl Dimer Dilinoleate only caused very minor irritation and did not produce a comedogenic effect.

Diisostearyl Dimer Dilinoleate. Rabbits were treated with .5 ml of a test substance containing Diisostearyl Dimer Dilinoleate (concentration was not stated).[1] The researchers stated that Diisostearyl Dimer Dilinoleate caused only very minor irritation and was not comedogenic.

Dermal Irritation and Sensitization

Irritation

Animal

Diisopropyl Dimer Dilinoleate. A dose of .5 ml Diisopropyl Dimer Dilinoleate was applied to 6 rabbits under an occlusive patch for 72 hours.[1] The primary irritation index (PII) was .10.

Dicetearyl Dimer Dilinoleate. The PII was 0.00 for New Zealand albino rabbits dosed with .5 ml Dicetearyl Dimer Dilinoleate using the same procedure as given above.[1] Dicetearyl Dimer Dilinoleate was considered not to be a skin irritant.

Diisostearyl Dimer Dilinoleate. A .5 ml dose of Diisostearyl Dimer Dilinoleate led to a PII of 0.00 using the same procedure as given above.[1] In a separate study, 6 New Zealand White rabbits were exposed to 10% Diisostearyl Dimer Dilinoleate in corn oil. A dose of .5 ml was applied and scored at 24 hours and 72 hours after application. The PII was .75, and 10% w/w Diisostearyl Dimer Dilinoleate produced minimal irritation.[1]

Dioctyldodecyl Dimer Dilinoleate. The PII was 0.00 in New Zealand rabbits dosed with .5 ml Dioctyldodecyl Dimer Dilinoleate applied dermally, and covered with an occlusive patch.[1] Dioctyldodecyl Dimer Dilinoleate was not a primary skin irritant.

Human

Diisopropyl Dimer Dilinoleate. Multiple studies were performed involving lip products that contained Diisopropyl Dimer Dilinoleate at a maximum concentration of 18%.[1] In one study, three of the twenty-five subjects with sensitive skin reported "a mild burning of the lips" and two reported "mild to moderate tautness of the lips"; the reactions were mild in intensity and transient in nature.

A moisturizer formulation containing 5% Diisopropyl Dimer Dilinoleate was not a dermal irritant.[1] The authors also concluded that makeup formulations containing 2% Diisopropyl Dimer Dilinoleate were not acnegenic, comedogenic, or irritating.

Diisostearyl Dimer Dilinoleate. Twenty subjects underwent a single-insult occlusive patch test (SIOPT) to test a concealer containing 10% Diisostearyl Dimer Dilinoleate.[1] The concealer, which was applied undiluted, had a PII of .084/4. In a different study, a 10% Diisostearyl Dimer Dilinoleate concealer was used for 5 days among 22 females, 15 of whom were lactic acid sensitive. Two subjects reported mild clinical changes, and one subject reported slight stinging.

Sensitization

Human

Diisopropyl Dimer Dilinoleate. A human repeated-insult patch test (HRIPT) was conducted using occlusive patches on 154 subjects to determine the sensitization potential of lipstick formulations containing 10%, 18%, or 27% Diisopropyl Dimer Dilinoleate.[1] One subject had a single 1+ response upon challenge [at the 10%], but overall, allergic responses were not observed. No reactions were recorded for the 27% or 18% group upon challenge.

A study evaluating the sensitization potential of a liquid makeup formulation was performed using .1 ml of test substance containing 2% Diisopropyl Dimer Dilinoleate, according to the same procedures above.[1] Of the 76 subjects completing this study, 16 had scores of 1 (mild reaction—faint/definitely pink) and 2 had scores of 1 and 2 (moderate

reaction—definite redness) during induction. Reactions were not observed upon challenge. In a modified Draize skin assay of a make-up formulation containing 3.5% Diisopropyl Dimer Dilinoleate, adverse reactions were not reported and the test substance was not a significant skin irritant or sensitizer.

Dicetearyl Dimer Dilinoleate. A test substance (.1 g or ml) containing Dicetearyl Dimer Dilinoleate was applied to the back under an occlusive patch (3 days/week for 3 weeks) in an HRIPT study involving 60 subjects.[1] After 10–14 days of no treatment, a challenge patch was applied to a previously unexposed area. Adverse reactions were not noted during the induction or challenge phase.

Diisostearyl Dimer Dilinoleate. The sensitization potential of an under eye concealer containing 10% Diisostearyl Dimer Dilinoleate was evaluated in a maximization test.[1] A sensitization reaction was not observed at the 48- or 72-h readings.

Dioctyldodecyl Dimer Dilinoleate. An HRIPT was completed in 60 subjects with occlusive patches of a test material containing Dioctyldodecyl Dimer Dilinoleate (.2 g or ml).[1] Adverse reactions were not noted during the induction or challenge phases.

Photosensitization/Phototoxicity

Human

Diisopropyl Dimer Dilinoleate. Cosmetic formulations containing 2–27% Diisopropyl Dimer Dilinoleate were not photosensitizers.[1]

Diisostearyl Dimer Dilinoleate. In a photosensitization study, it was concluded that a concealer containing 10% Diisostearyl Dimer Dilinoleate had no photocontact-sensitizing potential.[1]

Ocular Irritation Studies

Diisopropyl Dimer Dilinoleate

Six rabbits had .1 ml of a test substance containing Diisopropyl Dimer Dilinoleate placed into the conjunctival sac of one eye.[1] Observations were made for 7 days. No signs of irritation occurred.

A lip gloss and lipstick formulation containing 10% Diisopropyl Dimer Dilinoleate were placed into the conjunctival sac of rabbit eyes.[1] The lip gloss caused a maximum 1-h score of 4 for the conjunctivae, and the eyes were normal after one day. The lipstick caused a 1-h score of 2, and the eyes were normal after 3 days.

Dicetearyl Dimer Dilinoleate

In a Draize test conducted using six New Zealand white rabbits, Dicetearyl Dimer Dilinoleate (concentration not specified) had a maximum mean total score (MMTS) of 0.00.[1]

Diisostearyl Dimer Dilinoleate

The ocular irritation potential of Diisostearyl Dimer Dilinoleate (concentration not specified) was determined in a Draize test; the test substance did not cause irritation to rabbit eyes.[1] In a similar study, .1 ml of 10% w/w Diisostearyl Dimer Dilinoleate in corn oil was applied to the conjunctival sac of 6 New Zealand white rabbits. No irritation was observed.

Dioctyldodecyl Dimer Dilinoleate

One-tenth milliliters of Dioctyldodecyl Dimer Dilinoleate (concentration not specified) was placed in the conjunctival sac of the eye of 6 rabbits.[1] The MMTS was 0.00, and Dioctyldodecyl Dimer Dilinoleate was nonirritating.

Summary

In 2003, the Panel published a safety assessment with the conclusion that Diisopropyl Dimer Dilinoleate, Dicetearyl Dimer Dilinoleate, Diisostearyl Dimer Dilinoleate, Diethylhexyl [Dioctyl] Dimer Dilinoleate, Dioctyldodecyl Dimer Dilinoleate and Ditridecyl Dimer Dilinoleate are safe as used in the present practices of use. This assessment is a re-review of those original ingredients, as well as 2 additional dialkyl dimer dilinoleates (Di-C16-18 Alkyl Dimer Dilinoleate and Di-C18-20 Alkyl Dimer Dilinoleate). All ingredients reviewed are diesters of their respective alcohols and dilinoleic acid. Each ingredient is reported to function as a skin conditioning agent, however, Di-C20-40 Alkyl Dimer Dilinoleate also is also reported to function as a viscosity increasing agent.

Two of the eight ingredients included in this safety assessment are reported to be in use. Diisopropyl Dimer Dilinoleate has the highest frequency of use, with 145 total uses; the majority of these uses are in leave-on formulations, primarily in lipsticks (87 uses). Diisostearyl Dimer Dilinoleate has 20 reported uses. In the original safety assessment, the maximum concentration of use of Diisopropyl Dimer Dilinoleate was 53% in lipsticks, and the maximum concentration of use for Diisostearyl Dimer Dilinoleate was 12% in lipsticks. According to the Council survey conducted in 2018, concentration of use data also suggests that lipstick formulations contain the highest concentrations among the cosmetics reported to be in use. Diisopropyl Dimer Dilinoleate and Diisostearyl Dimer Dilinoleate had maximum concentrations of use of 29 and 16%, respectively. No new studies regarding toxicity were found in the published literature.

Because this is a re-review document, and no new data were found, the toxicity data reviewed by the Panel were summaries of studies that were described in the previous safety assessment performed on the dialkyl dimer dilinoleates. This published assessment can be found on the CIR website (https://www.cir-safety.org/ingredients).

Discussion

In accordance with its Procedures, the CIR evaluates the conclusions of previously-issued reports every 15 years. An amended report was published in 2003 for the original 6 dialkyl dimer dilinoleates with the conclusion of safe as used. That conclusion was reached based on negative genotoxicity assays, an absence of structural alerts to suggest mutagenic or carcinogenic risk, and an expectation of minimal dermal penetration when taking into account the insolubility of these dilinoleic acids in water, their lipophilic nature, and the estimated octanol/water partition coefficient of Diisopropyl Dimer Dilinoleate.

The Panel reaffirmed the original conclusion. Additionally, the Panel determined that it was appropriate to include 2 new ingredients to the dialkyl dimer dilinoleate ingredient family (Di-C16-18 Alkyl Dimer Dilinoleate and Di-C20-40 Alkyl Dimer Dilinoleate). Since these ingredients are structurally similar to the original 6 ingredients, the data in the existing report are sufficient to determine the safety of these new ingredients. The Panel noted that due to the size and lack of absorption of these dialkyl dimer dilinoleates, the need for systemic endpoints was mitigated.

Conclusion

The Expert Panel for Cosmetic Ingredient Safety concluded that the following dialkyl dimer dilinoleates are safe in cosmetics in the present practices of use and concentration described in this safety assessment:

Diisopropyl Dimer Dilinoleate
Dicetearyl Dimer Dilinoleate*
Diisostearyl Dimer Dilinoleate
Diethylhexyl Dimer Dilinoleate*
Dioctyldodecyl Dimer Dilinoleate*
Ditridecyl Dimer Dilinoleate*
Di-C16-18 Alkyl Dimer Dilinoleate*
Di-C20-40 Alkyl Dimer Dilinoleate*

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

Author's Note

Unpublished sources cited in this report are available from the Director, Cosmetic Ingredient Review, 1620L Street, NW, Suite 1200, Washington, DC 20036, USA.

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