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Final Report on the Safety Assessment of Myristyl Myristate and Isopropyl Myristate

Acute oral and dermal toxicity tests indicated that Myristyl Myristate is nontoxic to rats. This cosmetic ingredient produced minimal to mild skin irritation, minimal eye irritation in rabbits, and no sensitization in guinea pigs. Studies with rabbits indicated that undiluted Isopropyl Myristate was a mild irritant after 24 h and moderate to severe when applied for three consecutive days. Isopropyl Myristate was minimally irritating to the rabbits' eye, and was not a skin sensitizer in studies with guinea pigs. In limited studies, Isopropyl Myristate was not carcinogenic on the skin of mice, but a mixture of Isopropyl Myristate and isopropyl alcohol significantly accelerated the carcinogenic activity of benzo(a)pyrene on the skin.

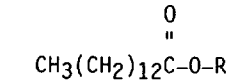
Human studies with Isopropyl Myristate indicated that it was not a human skin irritant or sensitizer when applied in a product formulation containing 15–58% of the ingredient. A product containing 43% Isopropyl Myristate produced no phototoxicity and no photocontact allergenicity in human studies.

From the available information, it is concluded that Myristyl Myristate and Isopropyl Myristate are safe as cosmetic ingredients in the present practices of use.

CHEMISTRY

Structures and Physical Properties

THE MYRISTATES are esters of myristic acid which have the following general formula:



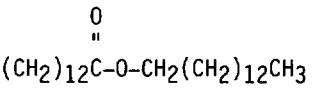
where R represents the alkyl moiety of Myristyl or Isopropyl alcohol.

The commercially available Myristates are mixtures of esters because of the technical grade of the myristic acid and the alcohols which are used as industrial starting materials (see Impurities section).

Myristic acid is commercially produced by the saponification and fractionation of animal or vegetable fats and oils. The isolated acid fraction is hydrogenated to produce the saturated fatty acid.[1]

Myristyl Myristate

Myristyl Myristate is the ester of myristyl alcohol and myristic acid. It conforms to the formula:[2]



The ingredient is produced by the esterification of myristic acid and myristyl alcohol in the presence of an acid catalyst. The product is stripped to remove excess myristyl alcohol, alkali is used to neutralize the catalyst, and then purified to separate Myristyl Myristate.[3]

TABLE 1. CHEMICAL AND PHYSICAL PROPERTIES OF THE MYRISTATES.[a]

Myristate	*Melting pt.*	*Freezing pt.*	*Boiling pt.*	*Sp. gr.*	*Refr. ind.*	*Ester value*	*Sapon. value*	*Acid value*	*Iodine value*
Myristyl	37°–39°C	—[b]	—	—	—	120–135	119–129	3.0 max.	1.0 max.
Isopropyl	—	3°–5°C[c]	192.6°C[c] at 20 mm Hg 140.2°C[c] at 2 mm Hg	0.847–0.853 at 25°C	1.432–1.430 at 25°C	202–220	—	1.0 max.	1.0 max.

[a]From Refs. 3, 4, 7–10.
[b]No data.
[c]Pure compound.

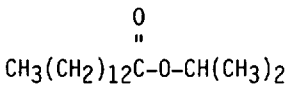
It is a white to yellow waxy solid with a characteristic waxy odor. It is soluble in mineral oil and insoluble in water, isopropyl alcohol, ethyl alcohol, glycerol, and propylene glycol.[4] The available chemical and physical properties of Myristyl Myristate are listed in Table 1.

The dielectric properties and thermodynamic parameters,[5] and the x-ray powder diffraction[6] of pure Myristyl Myristate have been described.

Other names include: Myristic Acid, Tetradecyl Ester, Tetradecyl Myristate, and Tetradecyl Tetradecanoate.

Isopropyl Myristate

Isopropyl Myristate is the ester of isopropyl alcohol and myristic acid. It conforms to the formula:[2]



Isopropyl Myristate is commercially produced by distillation, which is preceded by the esterification of myristic acid and isopropanol, in the presence of an acid catalyst. The product is stripped to remove excess isopropanol, alkali refined to neutralize the catalyst, and the product is then distilled to obtain Isopropyl Myristate.[7]

It is a colorless, almost odorless, mobile liquid with a bland taste. It is soluble in acetone, castor oil, chloroform, cottonseed oil, ethanol, ethyl acetate, mineral oil, and toluene and insoluble in water, glycerol, sorbitan, and propylene glycol. It is miscible with liquid hydrocarbons and fixed oils, and it dissolves lanolin, cholesterol, and many waxes.[8-10] The available chemical and physical properties of Isopropyl Myristate are listed in Table 1.

Suzuki et al.[11] reported the non-Newtonian flow of water-in-oil emulsions, and Lin and Lambrechts[12] described the effect of initial surfactant location on phase inversion of emulsions with pure Isopropyl Myristate.

Reactivity

The Myristates can be expected to undergo chemical or enzymatic hydrolysis to myristic acid and the corresponding alcohol. Trans-esterification and other typical ester reactions may also occur. All of these esters are saturated compounds and would not be expected to autoxidize readily.

Analytical Methods

The Myristates can be analyzed by thin-layer chromatography,[13] gas-liquid chromatography,[14] and x-ray powder diffraction.[6]

Impurities

The Myristates used as cosmetic ingredients are mixtures of fatty esters, since the myristic acid and alcohols used in the preparation of these ingredients are themselves mixtures of acids and alcohols, respectively. The CTFA Cosmetic Ingredient Chemical Description[1] for myristic acid lists the following as component acids:

n-Tetradecanoic Acid, $CH_3(CH_2)_{12}COOH$ ..... 95% min.
n-Hexadecanoic Acid, $CH_3(CH_2)_{14}COOH$ ..... 4% max.
n-Dodecanoic Acid, $CH_3(CH_2)_{10}COOH$ ..... 3% max.

Myristic acid may contain unsaponifiable material, mostly hydrocarbons, at a maximum concentration of 0.2%, and some grades may contain glyceryl monomyristate at a maximum concentration of 0.07%. Butylated hydroxytoluene (BHT) may be present as an added antioxidant.[1]

Myristyl Myristate

Free fatty acids, mainly myristic acid, are present at a maximum concentration of 1.5%. There are no known diluents, solvents, or additives present.[3]

Isopropyl Myristate

Myristic acid and other free fatty acids are present at a maximum concentration of 1.0%, and unsaponifiable material is present at a maximum concentration of 0.2%. There are no known diluents, solvents, or additives present.[7]

The ester composition is varied according to the specific usage requirement, provided that the specification limits conform to the following:[15]

Isopropyl Myristate: Not less than 90.0%
(limits: ± 5.0%)
Isopropyl Palmitate: Not more than 10.0%
(limits: ± 3.0%)
Isopropyl Laurate, Tridecanoate, Pentadecanoate, Heptadecanoate, and Stearate:
None more than 10.0%
(limits: 2.0% each)

USE

Purpose in Cosmetics

Myristyl Myristate

Myristyl Myristate is used as a wax base in cosmetic and pharmaceutical preparations.[16] It is a soft wax that melts at body temperature, imparting a velvety texture that persists after the rest of the formulation's ingredients have been rinsed off. In certain soap systems, an excess (3.5%) of Myristyl Myristate produces pearl effects. At very low levels (0.5–1%), it improves spreadability of emulsion makeups. It reduces the watery feel of hand and body lotions, and the use of 1–1.5% in these products imparts a richness equivalent to having doubled the oil phase.[17]

Isopropyl Myristate

Isopropyl Myristate is a light, colorless, oily liquid. It is an effective agent for solubilizing lanolin; mixtures of up to about 50% lanolin in Isopropyl Myristate remain stable, free-flowing liquids at room temperature. Therefore, Isopropyl Myristate is used as a solubilizing, spreading, and penetrating agent in anhydrous skin lubricating lotions with high lanolin content. Isopropyl Myristate leaves the skin soft and smooth without an oily surface film. It is used in bath oils, perfumes, creams, lotions, lipsticks, hair preparations, shaving lotions, aerosol toiletries, and pharmaceutical ointments.[17]

Scope and Extent of Use in Cosmetics

Table 2 lists product types and the number of product formulations containing the Myristates as reported to the FDA[18] in 1976. Myristyl Myristate was included in cosmetic products at concentrations up to 25%. Isopropyl Myristate was listed in all concentration ranges.

Products containing the Myristates are applied to all areas of the skin, hair, nails, and mucous membranes (Table 2). They may be applied several times a day and remain in contact with the skin for variable periods of time following each application. Daily or occasional use may extend over many years.

Noncosmetic Use

The Council of Europe[19] approved Isopropyl Myristate at a level of 5 ppm as an artificial flavoring substance that may be added to foodstuffs.

BIOLOGICAL PROPERTIES

General Effects

Isopropyl Myristate

Isopropyl Myristate was more toxic to gram-negative than to gram-positive bacteria; *Pseudomonas aeruginosa* was the most sensitive of the gram-negative bacteria tested.[20] The toxic effect may be the result of trace amounts of acidic catalysts that remain after production of the Isopropyl Myristate.[21] On the other hand, Isopropyl Myristate was used as a source of carbon by some of the many different kinds of microorganisms that can be isolated from cosmetic products. Microorganisms capable of utilizing the ingredient for growth included 12 of 23 strains of bacteria, all of 25 strains of yeast, and all of 17 strains of molds.[22]

The percutaneous absorption of salicylic acid and carboxamine from four different oily vehicles was investigated utilizing the intact and damaged skin of male guinea pigs. Absorption of these drugs from Isopropyl Myristate was intermediate as compared to mineral oil, oleic acid, and hexadecyl alcohol.[23] Dexamethasone penetrated stripped human skin seven times better when in gelled Isopropyl Myristate as compared with petrolatum USP; there was no difference in penetration through intact skin.[24] The ingredient also increased the penetrability of 0.025% betamethasone 17-benzoate through intact human forearm skin,[25] and it decreased the antifungal activity of

TABLE 2. PRODUCT FORMULATION DATA.[a]

Cosmetic product type	*Concentration*[b] *(percent)*	*No. of product formulations*
Myristyl Myristate		
Lotions, oils, powders, and creams	>1.0–5	1
	>0.1–1	1
Eye shadow	>5–10	6
	>1–5	13
	>0.1–1	7
Eye makeup remover	>5–10	1
Other make makeup preparations	>5–10	2
Perfumes	>5–10	30
Other fragrance preparations	>1–5	1
Hair conditioners	>0.1–1	1
Blushers (all types)	>1–5	1
Foundations	>5–10	1
	>1–5	3
Lipstick	>1–5	4
	>0.1–1	2
Makeup bases	>10–25	1
Rouges	>5–10	9
Cuticle softeners	>1–5	1
Aftershave lotions	>1–5	1
Other shaving preparation products	>1–5	1
Cleansing (cold creams, cleansing	>5–10	1
lotions, liquids, and pads)	>1–5	6
	>0.1–1	1
	≤0.1	1
Face, body, and hand (excluding	>1–5	11
shaving)	>0.1–1	2
Moisturizing	>5–10	5
	>1–5	13
	>0.1–1	21

TABLE 2. (Continued).

Cosmetic product type	*Concentration*[b] *(percent)*	*No. of product formulations*
Night	>5–10	2
	>1–5	3
	>0.1–1	2
Paste masks (mud packs)	>0.1–1	2
Wrinkle smoothing (removers)	>5–10	1
	>1–5	2
Isopropyl Myristate		
Baby lotions, oils, powders, and creams	>5–10 >1–5	3
Bath oils, tablets, and salts	>50 >25–50 >10–25 >5–10 >0.1–1 ≤0.1	137
Bubble baths	>25–50 >1–5	3
Bath capsule	>10–25	3
Other bath preparations	>50 >25–50 >10–25 >5–10 >1–5 ≤0.1	24
Eyebrow pencil	>1–5	14
Eyeliner	>1–5 >0.1–1	4
Eye shadow	>25–50 >10–25 >5–10 >1–5 >0.1–1 ≤0.1	246
Eye lotion	>25–50	1
Eye makeup remover	>25–50	1
	>10–25	1
	>5–10	1
	>1–5	1
Mascara	>5–10	1
	>1–5	3
	>0.1–1	19
Other makeup preparations	>25–50	3
	>10–25	4
	>5–10	6
	>1–5	10
	≤0.1	1
Eyebrow pencil	>1–5	1
Colognes and toilet waters	>10–25	1
	>5–10	2
	>1–5	10
	>0.1–1	12
	≤0.1	4

TABLE 2. (Continued).

Cosmetic product type	*Concentration*[b] *(percent)*	*No. of product formulations*
Perfumes	>50	1
	>25–50	31
	>10–25	8
	>5–10	3
	>0.1–5	12
	≤0.1	2
Powders (dusting and talcum) (excluding aftershave talc)	>1–5	27
	>0.1–1	65
	≤0.1	8
Sachets	>1–5	18
	>0.1–1	8
Other fragrance preparations	>50	1
	>25–50	13
	>10–25	3
	>1–5	8
	>0.1–1	13
Hair conditioners	>1–5	9
	>0.1–1	2
	≤0.1	1
Hair sprays (aerosol fixatives)	>1–5	2
	>0.1–1	3
Hair straighteners	>1–5	4
	>0.1–1	2
Permanent waves	>1–5	1
Rinses (noncoloring)	>1–5	3
	>0.1–1	1
	≤0.1	1
Shampoos (noncoloring)	≤0.1	1
Tonics, dressings, and other hair preparations	>25–50	1
	>5–10	1
	>1–5	5
	>0.1–1	3
Other hair preparations	>5–10	1
	>0.1–1	1
	≤0.1	1
Hair shampoos (coloring)	>0.1–1	1
Hair bleaches	>1–5	1
Blushers (all types)	>25–50	10
	>10–25	17
	>5–10	8
	>1–5	40
	>0.1–1	7
Face powders	>10–25	1
	>1–5	54
	>0.1–1	25
	≤0.1	5
Foundations	>50	1
	>25–50	40
	>10–25	33
	>5–10	46
	>1–5	34
	>0.1–1	5

TABLE 2. (Continued).

Cosmetic product type	*Concentration*[b] *(percent)*	*No. of product formulations*
Lipstick	>10–25	40
	>5–10	20
	>1–5	110
	>0.1–1	55
Makeup bases	>25–50	27
	>10–25	55
	>5–10	90
	>1–5	44
	>0.1–1	4
Rouges	>25–50	5
	>10–25	5
	>5–10	7
	>1–5	1
	>0.1–1	1
Makeup fixatives	>10–25	3
	>5–10	1
Other makeup preparations	>10–25	9
	>5–10	2
	>1–5	18
	>0.1–1	2
Cuticle softeners	>0.1–1	1
	≤0.1	1
Nail creams and lotions	>10–25	1
	>5–10	1
Other manicuring preparations	>1–5	1
Bath soaps and detergents	>1–5	1
Deodorants (underarm)	>10–25	3
	>5–10	2
	>1–5	8
	>0.1–1	2
Feminine hygiene deodorants	>10–25	1
	>1–5	11
	>0.1– 1	7
Other personal cleanliness products	>10–25	1
	>5–10	10
	>1–5	7
	>0.1–1	4
Aftershave lotions	>10–25	1
	>5–10	1
	>0.1–1	9
Men's talcum	>0.1–1	1
Preshave lotions (all types)	>10–25	20
	>5–10	8
	>1–5	3
Shaving creams (aerosol, brushless, and lather)	>1–5	1
Other shaving preparation products	>5–10	1
	>1–5	2
Cleansing (cold creams, cleansing lotions, liquids, and pads)	>10–25	3
	>5–10	10
	>1–5	17
	>0.1–1	5
	≤0.1	1

TABLE 2. (Continued).

Cosmetic product type	*Concentration*[b] *(percent)*	*No. of product formulations*
Face, body, and hand (excluding shaving preparations)	>50	1
	>10–25	12
	>5–10	5
	>1–5	76
	>0.1–1	38
	≤0.1	1
Foot powders	>0.1–1	6
Hormone	>1–5	1
	>0.1–1	1
	≤0.1	1
Paste masks (mud packs)	>10–25	1
	>5–10	1
	>1–5	2
Skin fresheners	>1–5	3
	≤0.1	2
Wrinkle smoothing (removers)	>25–50	1
	>10–25	1
	>5–10	1
	>1–5	1
	>0.1–5	1
	≤0.1	1
Other skin care preparations	>50	1
	>25–50	4
	>10–25	7
	>5–10	1
	>1–5	15
	>0.1–1	5
	≤0.1	1
Moisturizing	>25–50	4
	>10–25	14
	>5–10	27
	>1–5	56
	>0.1–1	16
	≤0.1	2
Night	>50	1
	>10–25	6
	>5–10	22
	>1–5	14
	>0.1–1	2
	≤0.1	1
Skin lighteners	>1–5	3
Suntan gels, creams, and liquids	>25–50	1
	>10–25	4
	>5–10	63
	>1–5	13
	>0.1–1	5
Other suntan preparations	>10–25	1
	>1–5	1

[a]From Ref. 18.

[b]Preset concentration ranges in accordance with federal filing regulations [21 CFR 720. 4(d)(1)].

paraben esters solubilized by surfactants.[26] Donovan et al.[27] noted that the solvent properties of Isopropyl Myristate may alter the particle size of the active ingredients in pharmaceutical formulations and in this way influence their therapeutic activity.

Absorption, Metabolism, Storage, and Excretion

Like other higher molecular weight aliphatic esters, the Myristates are readily hydrolyzed to the corresponding alcohols and acids which are then further metabolized.[28] Myristic acid is a digestible constituent of most vegetable and animal fats and is nontoxic when ingested.[29] When myristic acid was fed to dogs (as the ethyl ester), less than 2% of the amount fed was recovered as unabsorbed material in the feces; there was no increase in ether-soluble acids in the urine.[30]

Isopropyl Myristate

Four monkeys were exposed for 5 sec to the spray of an aerosol antiperspirant containing carbon-14 labeled Isopropyl Myristate.[31] Two animals were sacrificed immediately after exposure, and the other two were sacrificed 24 h later. The distribution of carbon-14 in the exhaled air and in several tissues indicated that only 0.25% of the dose sprayed at the animals was absorbed; about 10% of this reached the lower respiratory tract. Some 85% of the absorbed Isopropyl Myristate was eliminated in 24 h, mainly as exhaled carbon dioxide; very little labeled material reached any tissues other than the lungs.

Animal Toxicology

Acute Studies

Oral toxicity

Myristyl Myristate: The acute oral toxicity of Myristyl Myristate was evaluated in four separate studies.[32-35] In each study, young adult albino rats were fasted overnight and given a single administration of diluted or undiluted Myristyl Myristate by gastric intubation. They were then allowed free access to food and water for two weeks. A similar study was conducted on a cologne stick formulation containing 8 percent Myristyl Myristate.[36] The results and other details of these studies are summarized in Table 3. The acute oral LD50 of undiluted Myristyl Myristate in rats is greater than 14.4 g/kg.

Isopropyl Myristate: The acute oral toxicity of undiluted Isopropyl Myristate was evaluated in rats in four separate studies[37-40] and in mice in two studies.[41,42] Four product formulations containing Isopropyl Myristate were also evaluated for acute oral toxicity.[43-46] The results and other details of these studies are summarized in Table 3. The acute oral LD50 for undiluted Isopropyl Myristate is greater than 16 ml/kg in rats and 49.7 ml/kg in mice.

Dermal toxicity

Myristyl Myristate: Undiluted Myristyl Myristate was tested for acute dermal toxicity on ten albino rabbits.[47] The details of this study are summarized in Table 4.

Isopropyl Myristate: Undiluted Isopropyl Myristate and three product formulations containing it were tested for acute dermal toxicity.[44,45,48,49] The results and other details of these studies are summarized in Table 4.

Three guinea pigs were clipped free of abdominal hair and immersed up to their axillae in a 0.5 percent dispersion of Isopropyl Myristate in water at body temperature.[50] The animals were immersed four hours per day for three consecutive days. Two days after the last exposure, the abdominal skin was graded on a scale of 10 to 1 (10 = normal; 1 = most severe skin reaction). Each animal received a score of 8 or 7; there was moderate scaling and slight scurfing of the skin.

Primary skin irritation

Myristyl Myristate: The primary skin irritancy potential of Myristyl Myristate was tested in seven studies by a Draize single insult patch test technique or a slight modification of the test on the clipped intact and abraded skin of albino rabbits.[32,34,51-55] In each study, 0.5 ml samples of diluted or undiluted Myristyl Myristate were applied and occluded for 24 h, after which time the patch sites

TABLE 3. ACUTE ORAL TOXICITY TESTS ON THE MYRISTATES.

Ingredient	*Concentration (Percent)*	*Dose*	*Dose of Myristate (Adjusted for Dilution)*	*Animals*	*Results*	*Comments*	*Ref.*
Myristyl Myristate	100	5.0 g/kg	5.0 g/kg	5 rats	No deaths		32
	100	5.0 g/kg	5.0 g/kg	10 rats	1 death	Surviving animals appeared normal	33
		7.12 g/kg	7.12 g/kg	each dose	1 death	Surviving animals appeared normal	
		10.14 g/kg	10.14 g/kg		1 death	Surviving animals appeared normal	
		14.43 g/kg	14.43 g/kg		No deaths	LD50 > 14.43 g/kg	
	50 (in corn oil)	5.0 g/kg	2.5 g/kg	10 rats	1 death on Day 4	No information on other signs of toxicity was reported	34
	33 (in propylene glycol)	2.0 g/kg	0.7 g/kg	5 rats	No deaths	Unkempt coats for 12–16 h	35
		4.0 g/kg	1.3 g/kg	each dose	No deaths	Unkempt coats for 12–16 h	
		8.0 g/kg	2.7 g/kg		No deaths	Impaired locomotion; normal within 48 h	
		16.0 g/kg	5.3 g/kg		No deaths	Impaired locomotion	
		20.0 g/kg	6.7 g/kg		No deaths	Impaired locomotion	
		25.0 g/kg	8.3 g/kg		2 deaths on Day 2	Loss of motor control, coma before death	
		32.0 g/kg	10.7 g/kg		All died by Day 2	Animals lapsed into coma 30 min after intubation	
		64.0 g/kg	21.3 g/kg		All died within 1 h	Computed LD50 = 8.6 g/kg	
	8 (in product formulation)	5.0 g/kg	0.4 g/kg	—[a]	LD50 > 0.4 g/kg	Tested in rats	36

TABLE 3. (Continued).

Ingredient	Concentration (Percent)	Dose	Dose of Myristate (Adjusted for Dilution)	Animals	Results	Comments	Ref.
Isopropyl Myristate	100	5.0 ml/kg	5.0 ml/kg	6 rats	No deaths	No toxic effects	37
	100	8.0 ml/kg	8.0 ml/kg	10 rats	No deaths	No toxic effects	38
	100	10.0 g/kg	10.0 g/kg	10 rats	No deaths	No toxic effects	39
	100	16.0 ml/kg	16.0 ml/kg	–	"Tolerated"	Tested in rats	40
	100	40 ml/kg	40 ml/kg	10 mice	3 deaths	Computed LD50 = 49.7 ml/kg	41
		50 ml/kg	50 ml/kg	each dose	4 deaths		
		60 ml/kg	60 ml/kg		8 deaths		
		75 ml/kg	75 ml/kg		10 deaths		
	100	100 ml/kg	100 ml/kg	–	LD50 >100 ml/kg	Tested in mice	42
	52–58 (in product formulation)	20.0 g/kg	10.4–11.6 g/kg	10 rats	No deaths	Material administered as 40% w/v solution in corn oil. Minor signs of effect until Day 3	43
	43–47 (in product formulation)	5.0 ml/kg	2.15–2.35 ml/kg	10 rats	No deaths	Lethargy; no other signs of toxicity	44
	42.9 (in product formulation)	12.8 ml/kg	5.5 ml/kg	10 rats	Some deaths at all doses except 5.5 ml/kg	Calculated LD50 = 20.7 ml/kg for whole formulation	45
		16.0 ml/kg	6.9 ml/kg	each dose			
		20.0 ml/kg	8.6 ml/kg				
		25.0 ml/kg	10.7 ml/kg				
		31.25 ml/kg	13.4 ml/kg				
	15.0 (in product formulation)	10 ml/kg	1.5 ml/kg	–	LD50 >1.5 ml/kg	Tested in rats	46

[a] – No data.

TABLE 4. 24-HOUR DERMAL TOXICITY TESTS ON THE MYRISTATES.

Ingredient	*Concentration (Percent)*	*Dose*	*Dose of Myristate (Adjusted for dilution)*	*Animals*	*Results*	*Ref.*
Myristyl Myristate	100	2.0 g/kg	2.0 g/kg	10 rabbits	No deaths; Draize scores for up to 2 erythema and 1 for edema	47
Isopropyl Myristate	100	5.0 g/kg	5.0 g/kg	—[a]	LD50 5 g/kg; tested on rabbits	48
	52–58 (in product formulation)	2.0 ml/kg	1.04–1.16 ml/kg	6 rabbits	No deaths	49
	43–47 (in product formulation)	2.34 g/kg	1.0–1.1 g/kg	6 guinea pigs	No deaths and no abnormalities at autopsy; slight erythema up to 48 h	44
	42.9 (in product formulation; diluted by 50% with water)	10 ml/kg	2.15 ml/kg	8 rabbits	No deaths nor toxic signs; local skin effects, included erythema, edema, atonia, desquamation, and fissuring	45

[a] — No data.

were evaluated for erythema and edema by the Draize technique. The sites were again graded at 72 h. A similar test was conducted on a cologne stick containing 8% Myristyl Myristate.[36] The results and other details of these studies are summarized in Table 5. The undiluted ingredient produced minimal to mild irritation.

Isopropyl Myristate: The Draize primary skin irritation procedure or a slight modification of it was used to evaluate undiluted Isopropyl Myristate in five studies[56-60] and four product formulations containing this ingredient in five studies.[44-46,61] The results and other details of these studies are summarized in Table 5. The undiluted ingredient produced minimal irritation.

A 0.5 ml sample of undiluted Isopropyl Myristate was applied for three consecutive days to a 2 in^2 area of clipped skin on a total of 42 rabbits (7 studies).[37,62-67] There was edema, severe erythema, drying, cracking, and scaling. It was concluded that Isopropyl Myristate was moderately to severely irritating under the conditions of the tests.

Eye irritation

Myristyl Myristate: The Draize rabbit eye irritation procedure was used to evaluate Myristyl Myristate in six separate studies.[32,34,35,52,68,69] In each study, 0.1 ml of diluted or undiluted Myristyl Myristate was instilled into one eye of each rabbit with no subsequent washing; the untreated eye served as a control. The treated eyes were examined and graded on the Draize eye irritation scale at 24, 48, and 72 h. The Draize test was also used to evaluate a cologne stick containing 8% Myristyl Myristate.[36] The results and other details of these studies are summarized in Table 6. The undiluted ingredient produced only minimal eye irritation.

Isopropyl Myristate; The Draize rabbit eye irritation procedure or a modification of the test was used to evaluate undiluted Isopropyl Myristate in 10 separate studies[37,42,56,64-67,71-73] and four product formulations containing Isopropyl Myristate in four studies.[44-46,74] The results and other details of these studies are summarized in Table 6. The undiluted ingredient produced only minimal eye irritation.

Inhalation

Two product formulations containing Isopropyl Myristate were tested for acute inhalation toxicity in rats.[75,76] One aerosol antiperspirant containing 16–20% Isopropyl Myristate was dispensed from its commercial container for 6.5 sec/min for 1 h.[75] The nominal concentration of Isopropyl Myristate was 33–41 mg/l. The 20 exposed animals were lethargic and had slight muzzle and eye discharge during exposure, but they exhibited normal appearance and behavior throughout the 14-day post-exposure observation period. No deaths occurred, and no evidence of systemic toxicity was found at necropsy. Another aerosol antiperspirant containing 4.7% Isopropyl Myristate was tested on six rats.[76] The animals were exposed to a nominal concentration of 9.7 mg/l of Isopropyl Myristate for four 15-minute periods, each separated by a 5-minute fresh air period; six other rats served as control. There were no significant adverse effects during exposure, no deaths, and no findings at necropsy which distinguished treated from control animals.

Parenteral irritation

A volume of 0.3 ml of Isopropyl Myristate was injected intracutaneously into two areas of abdominal skin in each of five adult albino rabbits.[42] Using injected trypan blue as a diagnostic aid, the investigators found no indication of parenteral irritation.

Parenteral toxicity

No deaths occurred within 72 h after approximately 100 ml/kg of Isopropyl Myristate was injected intraperitoneally into two mice over a 4-hour period.[42]

Another study reported that the intraperitoneal and subcutaneous LD50s for Isopropyl Myristate exceeded 79.5 ml/kg in rats and that the intraperitoneal LD50 exceeded 50.2 ml/kg in mice.[40]

Subchronic Studies

Dermal toxicity

Isopropyl Myristate: An aerosol antiperspirant containing 16–20% Isopropyl Myristate was tested for cutaneous toxicity in a 26-day study.[77] Doses of 2 g/kg of the product were applied to the abraded backs of 10 rabbits five days a week for a total of 20 applications. A control group of 10

TABLE 5. DRAIZE PRIMARY SKIN IRRITATION TESTS ON THE MYRISTATES.

Ingredient	*Concentration (Percent)*	*Number of rabbits*	*Primary Irritation Index*	*Comments*	*Ref.*
Myristyl Myristate	100	18	0.11–1.50	Three studies with two assays each; nine rabbits per assay. Minimal to mild irritation	32, 51, 52
	100	18			
	100	18			
	100	6	1.13	Mild irritation	55
	100	3	0.5	Minimal irritation	53
	50 (in corn oil)	6	0.1	Minimal irritation	34
	5 (in liquid mineral oil)	3	0.0	No signs of irritation	54
	8 (in product formulation)	9	0.0	No signs of irritation	36
Isopropyl Myristate	100	18	0.22; 0.28	Two assays; nine rabbits per assay. Minimal irritation	56
	100	6	0.0	No signs of irritation	58
	100	6	0.17	Minimal irritation	60
	100	6	1.15	Minimal irritation	57
	100	3	0.75	Minimal irritation	59
	52–58 (in product formulation)	3	0.6	Minimal irritation	70
	43–47 (in product formulation)	24	0.04–0.25	Two studies with multiple assays. Minimal irritation	44, 61
	42.9 (in product formulation)	6	0.1	Exposure for 4 h. Minimal irritation	45
	15.0 (in product formulation)	9	1.67	Mild irritation	46

TABLE 6. DRAIZE EYE IRRITATION TESTS ON THE MYRISTATES.

Ingredient	Concentration (Percent)	Number of rabbits	Ocular Irritation Index 24 h	48 h	72 h	Comments	Ref.
Myristyl Myristate	100	6	0.0	0.0	0.0	No signs of irritation	52
	100	6	0.0	0.0	0.0	No signs of irritation	32
	100	6	2.67	1.0	0.33	Minimal irritation	69
	50 (in corn oil)	6	1.3	0.33	0.0	Minimal irritation	34
	15 (in corn oil)	6	3.67	2.0	0.0	Minimal irritation	35
	8 (in product formulation)	6	1.0	0.0	0.0	Minimal irritation	36
	5 (in light mineral oil)	3	0.0	0.0	0.0	No signs of irritation	68
Isopropyl Myristate	100	6					65
	100	6					66
	100	6					67
	100	6		0.0–1.0		Minimal irritation	56
	100	6					71
	100	3					72
	100	—[a]		—		OIIs of 2.8 and 1.2 at one and two hours, respectively, indicating minimal irritation	42
	100	3	0.0	0.0	0.0	Eyes treated daily for 3 consecutive days	64
	100	3	0.0	0.0	0.0	Eyes treated daily for 3 consecutive days	73
	100	3	1.3	1.3	2.0	Eyes treated daily for 3 consecutive days. Scores of 1.3 and 0.0 at 4 and 7 days, respectively	37
	52–58 (in product formulation)	3	11	—	—	No wash; mild irritation	74
		3	9	—	—	Tap water wash after 4 seconds; minimal irritation	
		3	10	—	—	10% dispersion of test material in water; mild irritation	
	43–47 (in product formulation)	6	3.33	1.33	2.0	4-second spray from aerosol container; minimal irritation	44
	42.9 (in product formulation)	6	—	—	—	Unwashed; minimal irritation	45
		3	—	—	—	Water wash after 30 seconds; minimal irritation	
	15.0 (in product formulation)	—	0.0	0.0	0.0	No signs of irritation	46

[a] — No data.

rabbits was treated with distilled water. None of the animals died, but they showed severe erythema, moderate edema, desquamation, slight coriaceousness, moderate fissuring, and atonia. No changes considered to be related to the product were seen in general behavior and appearance, body weights, or hematological studies. Microscopically, the treated skin of all experimental rabbits showed marked to severe acanthosis and hyperkeratosis with varying degrees of parakeratosis and mixed inflammatory cell infiltration.

In another study, an aerosol antiperspirant concentrate containing 43–47% Isopropyl Myristate was tested for four weeks.[78] Six rabbits received 2 ml/kg five days a week, for a total of 21 skin applications. A control group of six rabbits remained untreated. One animal from the test group died after four applications. The cause of death was not determined but was considered unrelated to the test. Signs of product-related changes in the skin included erythema, edema, drying, cracking, and fissuring. No significant pathological changes were discovered at necropsy other than those of the skin at the site of contact.

Skin irritation

Isopropyl Myristate: Daily cutaneous application of undiluted Isopropyl Myristate for up to 28 days on mice and up to 14 days on rabbits produced an immediate erythema followed by lichenification and fissure formation.[79] There was acanthosis, parakeratosis, hyperkeratosis, focal erosion, and focal hemorrhage. The skin lesions regressed slowly after cessation of treatment in rabbits, but in mice they tended to regress during continued treatment. Similar reactions occurred with combinations of Isopropyl Myristate and peanut oil, but the intensities of the dermatoses were generally related to the proportion of Isopropyl Myristate in the mixture. Peanut oil alone produced only mild gross and microscopic changes.

A bath oil containing 42.9% Isopropyl Myristate was tested in a 10-day cumulative skin irritation study.[45] Doses of 0.5 ml were applied daily to the intact and abraded skin of three albino rabbits for 10 consecutive days. A 2.0% aqueous dispersion was used during Days 1–4, and the undiluted product formulation was applied on Days 5–10. The 2.0% dispersion elicited no irritation during the first four days of the study, but the undiluted formulation produced irritation which increased progressively with each application up to a maximum Draize irritation index of 5.3 on Day 10. It was concluded that the product produced moderate skin irritation upon repeated application to rabbit skin.

Skin sensitization

Myristyl Myristate: The sensitization potential of Myristyl Myristate was assessed in two studies using the Landsteiner and Jacobs guinea pig technique or a modification of it.[80,81] The undiluted ingredient was applied topically in one study, and a 0.1% suspension in physiological saline was injected intracutaneously in the other. The backs and flanks of male guinea pigs were clipped, and treatments were made three times a week for a total of 10 treatments. The first treatment consisted of 0.05 ml, and the remaining nine were 0.1 ml each. A challenge treatment of 0.05 ml was made two weeks after the tenth sensitization treatment. The study which used topical application of the undiluted ingredient on ten animals reported minimal skin irritation but no sensitization.[81] The study which employed the intracutaneous injection technique with eight animals likewise reported no signs of sensitization.[80]

Isopropyl Myristate: The Landsteiner and Jacobs guinea pig sensitization technique was used on two animals to evaluate Isopropyl Myristate suspended at 0.1% in physiological saline. There was no evidence of sensitization.[82] A similar test with Isopropyl Myristate on 10 guinea pigs gave no indication of allergic or other type of sensitivity.[42]

Bergwein[83] describes Isopropyl Myristate as a nonsensitizer free of dermatological complications.

Inhalation

Isopropyl Myristate: A 13-week inhalation toxicity study was performed on an aerosol antiperspirant containing 16–20% Isopropyl Myristate.[84] Two test groups of 20 guinea pigs and a control group of 40 animals were used. The test groups were exposed to a mean concentration of 63.3 or 224 mg/m^3 of air for three 1-hour exposures per day, seven days per week. The control group was ex-

posed to air. After four weeks, half of the animals were sacrificed. The remaining animals were treated under the same regimen for a total of 13 weeks. All animals appeared normal, except for one female that died during the course of the study from unknown causes. Both absolute and relative lung weights increased in the exposed guinea pigs when compared to the controls. Gross necropsy and microscopic examination of tissues from the animals sacrificed after 28 and 91 days revealed no other evidence of treatment-related effects.

The same aerosol antiperspirant containing 16–20% Isopropyl Myristate was tested in another 13-week inhalation toxicity study using cynomolgus monkeys.[85] Test groups of nine animals were exposed to a gravimetric concentration of 5.3, 8.4, 33.6, or 37.0 mg/m^3 in air for three 1-hour exposures per day, seven days per week for 13 weeks. A control group of nine monkeys was exposed to room air under identical conditions. During the study, the treated animals wheezed and coughed, and blood was discharged from the noses of two animals exposed to 8.4 mg/m^3. Lung function tests after six and 13 weeks were normal, as were the results of hematology, blood chemistry, and urinalysis. There were no gross lesions seen at necropsy, and organ/body weight ratios were comparable to those of controls. The lungs of the animals from the treatment groups had accumulations of macrophages within the alveolar and bronchiolar walls. The severity of this response was directly proportional to the dosage level of the aerosol.

Parenteral toxicity

Isopropyl Myristate: A mixture of 25% Isopropyl Myristate and 75% peanut oil produced only minor local damage without definitive systemic effects when injected intramuscularly once a week for up to 12 weeks at levels of 0.3 ml/kg in 48 rats, 0.14 ml/kg in four beagle dogs, and 0.15–0.33 ml/kg in two rhesus monkeys.[79]

Special Studies

Carcinogenicity

Isopropyl Myristate: In a preliminary study, a 50% solution of Isopropyl Myristate in isopropyl alcohol significantly accelerated the carcinogenic activity of 0.15% benzo[a]pyrene on the skin of mice.[86] No tumors were produced when 0.1 ml of a 1% solution of Isopropyl Myristate was applied once a week for 18 weeks to the clipped skin of an unreported number of mice.[87]

Isopropyl Myristate was applied twice a week to the backs of female Swiss mice from the age of seven weeks until the animals died between the ages of 10 and 110 weeks; the average lifespan was approximately 80 weeks.[88] Drops of 0.02 ml were applied to groups of 50 animals each at concentrations of 100%, 50%, and 10% Isopropyl Myristate diluted with acetone. Control groups consisted of 135 untreated animals, 50 treated with acetone, and 50 treated with 7,12-dimethylbenzanthracene for a positive control. In the Isopropyl Myristate treated groups, one animal developed a keratoacanthoma on an eyelid at 50% and one a squamous cell papilloma on the abdomen at the 10% concentration. The skin tumor frequency seen in the treated animals did not differ from that of the acetone control and untreated control animals. Isopropyl Myristate did not produce lesions in other organs.

Other Special Studies

No information was available on any of the Myristates with respect to pharmacokinetics, pharmacodynamics, teratogenesis, or mutagenesis.

Clinical Assessment of Safety

Clinical studies are reviewed below and then summarized in Table 7.

Myristyl Myristate

Primary skin irritation

A cologne stick product containing 8% Myristyl Myristate was tested for primary skin irritation using a 24-hour occlusive patch test technique.[89] The product was applied full strength as dispensed from the product container in an unreported amount to 20 subjects. There was no sign of irritation in 19 subjects; one subject received a score of 1.0 on the Draize scale. The Primary Irritation Index (PII) was calculated to be 0.05.

TABLE 7. CLINICAL STUDIES ON THE MYRISTATES.

Ingredient	*Test*	*Method*	*Conc. (Percent)*	*No. of subjects*	*Results*	*Ref.*
Myristyl Myristate	Primary Skin Irritation	24-hour occlusive patch	8 in product formulation	20	No irritation in 19 subjects, one with mild erythema; PII = 0.05	89
	Skin Sensitization	Repeat insult with challenge	8 in product formulation	196	No sensitization	90
Isopropyl Myristate	Primary Skin Irritation	24-hour occlusive patch	100	15	No irritation	91
		48-hour occlusive patch	20 in petrolatum	—[a]	No irritation	92
		24-hour occlusive patch; 3 applications	52–58 in product formulation	9	No irritation	93
		24-hour occlusive patch; 10 applications	42.9 in product formulation	10	No irritation	45
		24-hour occlusive patch; 3 separate studies	43–47 in product formulation	50	1 case mild erythema, 6 cases doubtful erythema; PII = 0.05	94–96
		24-hour occlusive patch; 2 separate studies	15.0 in product formulation	38	1 case mild erythema, 2 cases doubtful erythema; PII = 0.1	97,98
	Cumulative Skin Irritation	Daily application for 21 days; 2 separate studies	100	25	Minimal irritation; less than for baby oil control	99,100

TABLE 7. (Continued).

Ingredient	*Test*	*Method*	*Conc. (Percent)*	*No. of subjects*	*Results*	*Ref.*
		Daily application for 21 days	52–58 in product formulation	9	Minimal irritation	101
		Daily application for 21 days	15.0 in product formulation	13	Minimal irritation	102
	Skin Sensitization	Kligman Maximization Test	20 in petrolatum	25	No sensitization	92
		Kligman Maximization Test	42.9 in product formulation	25	No sensitization	45
		Repeat insult with challenge	52–58 in product formulation	320	No sensitization, mild irritation	103
		Repeat insult with challenge	15.0 in product formulation	99	No sensitization, minimal irritation	104
	Phototoxicity	UV range A	42.9 in product formulation	10	No phototoxicity	45
	Photo-Contact Allergenicity	UV range A; multiple induction with challenge	42.9 in product formulation	25	No photo-contact allergenicity	45

[a] – No data.

Skin sensitization

The same cologne stick containing 8% Myristyl Myristate was tested in a repeated insult patch test on 196 subjects.[90] The product was applied under an occlusive patch on one arm of each subject three days a week for a total of 10 induction exposures. A challenge exposure was made after a 14-day rest period. There was no evidence of skin sensitization.

Isopropyl Myristate

Primary skin irritation

Undiluted Isopropyl Myristate was tested in a 24-hour occlusive patch test for primary skin irritation.[91] An unspecified quantity of the ingredient was applied to 15 subjects with no adverse reactions.

No irritation was observed in a 48-hour occlusive patch test with 20% Isopropyl Myristate in petrolatum on an unreported number of human subjects.[92]

A total of seven studies tested four different product formulations containing Isopropyl Myristate for primary skin irritation. In one study,[93] an aerosol antiperspirant concentrate containing 52–58% Isopropyl Myristate was tested on nine subjects. The product was applied and occluded for 24 hours every other day for three applications. No irritation was observed. In a second study,[45] doses of approximately 0.3 ml of a bath oil containing 42.9% Isopropyl Myristate were applied repeatedly under occlusion to the same site on six men and four women. Daily application for 10 days produced no irritation. An aerosol antiperspirant containing 43–47% Isopropyl Myristate was tested in three separate studies on a total of 50 subjects.[94-96] A single 24-hour insult produced one case of mild and six cases of doubtful erythema for a combined PII of 0.05. In the last two studies,[97,98] a facial mask containing 15.0% Isopropyl Myristate was tested for 24 h on a total of 38 subjects. It produced one case of mild and two cases of doubtful erythema for a combined PII of 0.1.

Cumulative skin irritation

The cumulative skin irritation characteristics of undiluted Isopropyl Myristate were evaluated in two separate studies with a total of 25 subjects.[99,100] Daily application for 21 days produced only very slight irritation, the scores for which totaled less than those for a baby oil control.

Two samples of an aerosol antiperspirant containing 52–58% Isopropyl Myristate were tested in a modified Lanman–Maibach 21-day irritancy test.[101] A volume of 0.3 ml of the product was applied daily for 21 consecutive days to each of two test sites on the backs of four men and five women of various ages. There was no evidence of any pigmentation changes, and the product produced only a slight skin irritation.

Another Lanman–Maibach type 21-day cumulative irritancy assay tested a facial mask formulation containing 15.0% Isopropyl Myristate on 13 subjects.[102] The cumulative irritation score was 50 out of a possible maximum of 520, indicating minimal irritation.

Sensitization

A maximization test [105,106] was carried out on 25 volunteers using 20% Isopropyl Myristate in petrolatum. After pretreatment with sodium lauryl sulfate, the skin on the volar surface of one forearm was subjected to five sequential patches, each for 48 h with 24 h between. A challenge patch with sodium lauryl sulfate pretreatment was made after a 10-day rest. No sensitization reactions were produced.[92]

Another maximization assay[105,106] was conducted on eight men and 17 women to evaluate the sensitization properties of a bath oil formulation containing 42.9% Isopropyl Myristate. No reactions were observed after either induction or challenge patches.[45]

Four separate human sensitization studies testing an aerosol antiperspirant concentrate containing 52–58% Isopropyl Myristate produced no reactions indicative of sensitization in a total of 320 subjects. The nine 24-hour induction exposures and one challenge patch showed the product to be mildly irritating to the skin.[103]

A facial mask formulation containing 15.0% Isopropyl Myristate was tested in a repeated insult patch test on 99 subjects. It produced slight irritation but no evidence of sensitization.[104]

One woman showed a strongly positive patch test to Isopropyl Myristate when 30 women were patch tested to the individual ingredients in 12 different feminine hygiene sprays. Each woman had

previously suffered from a vulvar and inguinal or thigh dermatitis caused by one of the products.[107] Such a biased subject group does not allow any conclusions to be made on the potential for sensitization in the general population.

Phototoxicity

A phototoxicity study with a bath oil formulation containing 42.9% Isopropyl Myristate was conducted on one man and nine women.[45] The material was applied undiluted at 5 $\mu l/cm^2$ under occlusive patches. Sites were irradiated after 6 and 24 h with a 150-watt Xenon Solar Simulator fitted with a Schott WG345 filter to eliminate UV B radiation, giving a total UVA irradiance of 25–30 mW/cm^2. No evidence of phototoxicity was observed.

Photo-contact allergenicity

A bath oil containing 42.9% Isopropyl Myristate was tested for photo-contact allergenicity on seven men and 18 women.[45] Applications of 5 $\mu l/cm^2$ under an occlusive patch for 24 h, followed by three minimal erythema doses of irradiation from a Xenon Solar Simulator, were repeated twice a week for three weeks. A challenge patch followed by 25–30 mW/cm^2 UVA for five minutes from the solar simulator fitted with a Schott WG345 filter was performed 10 days after the last induction exposure. No evidence of photo-contact allergenicity was observed.

SUMMARY

The Myristates are esters of myristic acid and myristyl or isopropyl alcohol. They are used in a wide variety of cosmetic products and may be applied to all areas of the skin. Myristates are readily hydrolyzed to their corresponding alcohols and acids which are then further metabolized.

Myristyl Myristate, undiluted and diluted with corn oil or propylene glycol, was nontoxic when fed to rats. The acute oral LD50 of the undiluted material is estimated to be greater than 14.4 g/kg. Acute studies on Myristyl Myristate with rabbits showed no dermal toxicity, minimal to mild skin irritation, and minimal eye irritation. Guinea pig sensitization studies produced no evidence of skin sensitization. No other subchronic data on Myristyl Myristate were available. A human primary skin irritation study showed a product formulation containing 8% Myristyl Myristate to be minimally irritating. A human skin sensitization study on the same product produced no evidence of sensitization. No human data were available on Myristyl Myristate at higher concentrations.

Isopropyl Myristate was tested for acute oral toxicity in both rats and mice. In rats, the acute oral LD50 was estimated to be greater than 16.0 ml/kg; in mice, the LD50 was calculated to be 49.7 ml/kg. There were no signs of acute dermal toxicity when Isopropyl Myristate was applied undiluted and in product formulations. A guinea pig immersion study with Isopropyl Myristate at 0.5% produced only mild skin irritation. Subchronic dermal toxicity studies with product formulations containing 16–47% Isopropyl Myristate applied for four weeks showed no systemic toxicity. In primary skin irritation studies with rabbits, undiluted Isopropyl Myristate produced no more than mild irritation in 24 h; it produced moderate to severe irritation when applied for three consecutive days. Subchronic skin irritation studies for 28 days with mice and 14 days with rabbits showed moderate irritation. Acute inhalation of aerosols of product formulations containing up to 20% Isopropyl Myristate produced no systemic toxicity. Subchronic 13-week inhalation studies in guinea pigs and monkeys on a product containing 16–20% Isopropyl Myristate showed only local lung effects. Acute parenteral studies with intracutaneous, subcutaneous, and intraperitoneal injection into rabbits, mice, or rats produced no systemic toxicity and high LD50 values. Intramuscular injection of 25% Isopropyl Myristate in peanut oil for 12 weeks produced only minor local damage in rats, dogs, and monkeys. Isopropyl Myristate was minimally irritating to the rabbit eye, and was not a skin sensitizer in studies with guinea pigs. Isopropyl Myristate was minimally irritating to the rabbit eye, and was not a skin sensitizer in studies with guinea pigs. Isopropyl Myristate was not carcinogenic on the skin of mice, but a mixture of Isopropyl Myristate and isopropyl alcohol significantly accelerated the carcinogenic activity of benzo(a)pyrene on the skin.

Human primary skin irritation studies showed no reactions to Isopropyl Myristate alone and up to mild irritation from product formulations containing 15–58% Isopropyl Myristate. Repeated appli-

cation of undiluted Isopropyl Myristate for 21 days produced only slight irritation. Isopropyl Myristate was not a human skin sensitizer when in petrolatum or in product formulations at 15–58%, although one woman who had suffered from a vulvar dermatitis caused by a feminine hygiene spray was found to be sensitized to this ingredient. A product containing 43% Isopropyl Myristate produced no phototoxicity and no photo-contact allergenicity in human studies.

CONCLUSION

From the available information, the Panel concludes that Myristyl Myristate and Isopropyl Myristate are safe as cosmetic ingredients in the present practices of use.

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