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# Safety Assessment of Amino Acid Alkyl Amides as Used in Cosmetics

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## **Cosmetic Ingredient Review**

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## INTRODUCTION

This scientific literature review summarizes the available data relevant to assessing the safety of 115 amino acid alkyl amides as used in cosmetics. These ingredients mainly function as skin and hair conditioning agents and as surfactants-cleansing agents in personal care products. The list of ingredients in this report is found in Table 1.

By and large, the ingredients in this report will rapidly dissociate in the presence of water. The relative exposure, hence, would be to amino acids and fatty acids, carboxylic acids, or dicarboxylic acids. A concurrent review of the safety of plant- and animal-derived amino acid and hydrolyzed protein ingredients as they are used in cosmetics is being performed by the Cosmetic Ingredient Review (CIR) Expert Panel. The Panel previously has reviewed the safety of  $\alpha$ -amino acids and concluded that these ingredients are safe for use in cosmetic ingredients.<sup>1</sup> The Panel also reviewed the following constituents and concluded that these ingredients are safe for use in cosmetic ingredients: coconut acid, olive acid, sunflower seed acid, palm acid, acetic acid, dicarboxylic acids, lauric acid, oleic acid, palmitic acid, stearic acid, and myristic acid.<sup>2-9</sup> The Panel has concluded that data are sufficient to determine safety for malic acid.<sup>10</sup> The maximum concentrations of use along with summaries of the data included in those existing safety assessments are provided in Table 2.

## CHEMISTRY

The ingredients in the report, the amino acid alkyl amides, are comprised of amino acids acylated with acids or acid chlorides at the amino acid nitrogen, to form amides. For example, capryloyl glycine is the *N*-acylation product of glycine with caprylic acid chloride.

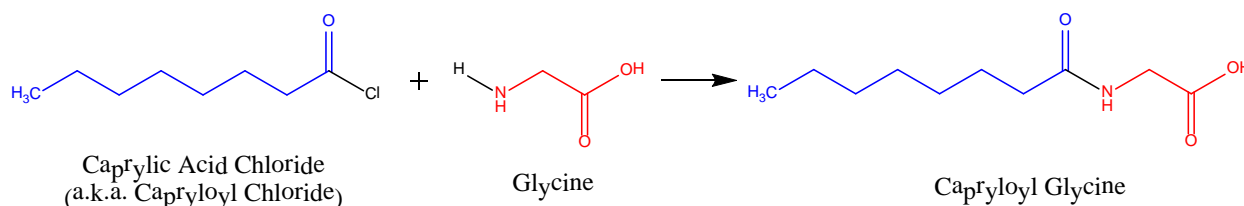


Figure 1. Synthesis of the amino acid alkyl amide, Capryloyl Glycine.

A likely metabolic pathway for these ingredients is to be acted upon by amidases, should they penetrate the skin. The net result therein would be the release of the amino acid (glycine in the above case) and a fatty acid (caprylic acid in the above case).

The definitions of the amino acid alkyl amides can be found in Table 1 and the structures can be found in Table 3.

### Physical and Chemical Properties

The ingredients in this report are typically water soluble, waxy solids. Available chemical properties can be found in Table 4.

### Method of Manufacturing

As shown in Figure 1, the ingredients in this report are most commonly manufactured by the acylation of a free amine of an amino acid with an acyl chloride, a reaction known as the Schotten-Baumann reaction.<sup>11-13</sup> The major side product for this reaction is hydrochloric acid, which can be easily removed.

### Disodium Capryloyl Glutamate, Sodium Cocoyl Glutamate and Sodium Lauroyl Glutamate

According to a supplier, disodium capryloyl glutamate, sodium cocoyl glutamate, and sodium lauroyl glutamate are produced via the Schotten-Baumann reaction.<sup>14-16</sup> The supplier also described the origin of starting materials: glutamic acid is obtained through formation of glucose/molasses or from wheat and capryloyl chloride, cocoyl chloride, and lauroyl chloride are obtained from caprylic acid, coconut acid and lauric acid that come from cleavage and distillation of coconut oil. The respective resultant materials are aqueous solutions comprised of 37%-41% disodium capryloyl glutamate, 32.6%-38% sodium cocoyl glutamate, and 36%-40% sodium lauroyl glutamate.

### Impurities

#### Disodium Capryloyl Glutamate

A supplier has reported that disodium capryloyl glutamate may contain 4%-6% propylene glycol, 3% caprylic acid (max.), 5% disodium glutamate (max.), and 6-8% sodium chloride.<sup>14</sup> Disodium capryloyl glutamate

may also contain < 2 ppm arsenic, < 5 ppm antimony, < 1 ppm lead, < 2 ppm cadmium, < 2 ppm mercury, < 1 ppm nickel, < 2 ppm chromium, and < 10 ppm total heavy metals (as iron).

#### Sodium Cocoyl Glutamate

The same supplier has reported that sodium cocoyl glutamate may contain 4%-6% propylene glycol, 5% (max.) sodium glutamate, 3% coconut acid, and 4%-5.5% sodium chloride.<sup>16</sup> Sodium cocoyl glutamate may also contain < 2 ppm arsenic, < 5 ppm antimony, < 1 ppm lead, < 2 ppm cadmium, < 2 ppm mercury, < 1 ppm nickel, < 2 ppm chromium, and < 10 ppm total heavy metals (as iron).

#### Sodium Lauroyl Glutamate

A supplier has reported that sodium lauroyl glutamate may contain 4%-6% propylene glycol, 5% (max.) glutamic acid, 3% (max.) lauric acid, and 3%-4.5% sodium chloride.<sup>15</sup> Sodium lauroyl glutamate may also contain < 2 ppm arsenic, < 5 ppm antimony, < 1 ppm lead, < 2 ppm cadmium, < 2 ppm mercury, < 1 ppm nickel, < 2 ppm chromium, and < 10 ppm total heavy metals (as iron).

### USE Cosmetic

Table 5a presents the current product-formulation data for amino acid alkyl amides. These ingredients function primarily as skin and hair conditioning agents and surfactants.<sup>17</sup> According to information supplied to the Food and Drug Administration (FDA) by industry as part of the Voluntary Cosmetic Registration Program (VCRP), lauroyl lysine has the most reported uses in cosmetic and personal care products, with a total of 604; most uses are in leave-on eye and facial makeup.<sup>18</sup> Sodium cocoyl glutamate has the second greatest number of overall uses reported, with a total of 132; a little more than half of those uses are in rinse-off products.

In the Personal Care Products Council's use concentration survey, lauroyl lysine had a wide maximum use concentration range of 0.001% to 45% with the 45% reported in lipsticks. Sodium lauroyl glutamate also had a wide maximum use concentration range of 0.003% to 40%, with the 40% reported in skin cleansing agents. All other use concentrations that were reported had similar ranges.

Those ingredients with no reported uses or use concentrations are listed in Table 5b.

In some cases, reports of uses were received from the VCRP, but no concentration of use data were available. For example, palmitoyl keratin amino acids are reported to be used in 5 formulations, but no use concentration data were available. In other cases, no reported uses were received from the VCRP, but a use concentration was provided in the industry survey. For example, cocoyl glutamic acid was not reported in the VCRP database to be in use, but the industry survey indicated that it is used in leave-on formulations at maximum concentrations ranging from 24%. It should be presumed that cocoyl glutamic acid is used in at least one cosmetic formulation.

In the European Union, trialkylamines, trialkanolamines, and their salts (ingredients containing TEA) may only be used up to 2.5%, must be at least 99% pure, are not to be used with nitrosating systems, must have a maximum secondary amine content of 0.5%, must have a maximum nitrosamine content of 50 µg/kg, and must be kept in nitrite-free containers.<sup>19</sup> The remaining ingredients are not restricted from use in any way under the rules governing cosmetic products in the European Union.

### **Non-Cosmetic**

Amino acid alkyl amides are used in household detergents.<sup>20</sup>

Acetyl cysteine has been approved by the FDA to treat acetaminophen overdose and as a mucolytic therapy.<sup>21</sup> Acetyl methionine is an approved dietary supplement (21 CFR §172.372).

### TOXICOKINETICS

#### **Absorption, Distribution, Metabolism, Excretion**

A percutaneous absorption study of 3 formulations containing 1.75% acetyl tyrosinamide was performed in vitro on human trunk skin using the finite dose technique and Franz diffusion cells.<sup>22</sup> The formulations were a gel, a cream, and a water solution in silicone. Each formulation was evaluated on 3 replicate sections from 2 different ex vivo human trunk skin donors. At dosing, 10 mg formulation/cm<sup>2</sup>/skin-section equivalent volume was dispensed by pipette and a glass rod was used to evenly distribute the formulation into the skin. The percutaneous absorption of the test material was determined over a 48-h dose period. At 6, 12, 32, and 48 h after application, the dermal receptor solution was removed in its entirety, replaced with stock receptor solution, and 4 ml aliquot was saved for subsequent analysis. After the last receptor solution collection, the skin surface was washed twice with

50:50 methanol:water to collect unabsorbed formulation from the skin. The glass rod used for dosing, the surface wash, stratum corneum, epidermis, and dermis were recovered and evaluated for compound content. The samples were analyzed for test material content using high performance liquid chromatography (HPLC) method.

In the formulation with water, the test material was found in the following mean distribution: 0.479% in receptor solution, 0.038% in dermis, 1.252% in epidermis, 4.639% in stratum corneum, and 83.15% in surface wash (total recovery was 89.554%). For the gel formulation, the test material was found in the following mean distribution: 1.031% in receptor solution, 0.066% in dermis, 1.149% in epidermis, 0.695% in stratum corneum, and 88.59% in surface wash (total recovery was 91.532%). Finally, in the cream formulation, the test material was found in the following mean distribution: 2.702% in the receptor solution, 0.386% in the dermis, 15.963% in the epidermis, 11.909% in the stratum corneum, and 54.336% in the surface wash (total recovery was 85.296%). The authors of the study concluded that acetyl tyrosinamide does penetrate into and through ex vivo human skin using the in vitro finite dose model in all 3 formulations evaluated. The authors noted that one donor skin exhibited greater permeability to acetyl tyrosinamide than the other.<sup>22</sup>

### **TOXICOLOGICAL STUDIES**

The amino acids alkyl amides in this assessment most likely dissociate into amino acids and fatty acids in the presence of water. Because most of these amino acids and fatty acids are found in the foods we consume daily, oral toxicity is not expected. In turn, dermal toxicity would not be expected to be different from oral exposures. Irritation and sensitization are of concern, and the focus in this report. Data from the previous safety assessments on  $\alpha$ -amino acids and fatty acids support that these ingredients would not likely be irritants or sensitizers.

### **REPRODUCTIVE AND DEVELOPMENTAL TOXICITY**

No published reproductive and developmental toxicity studies on amino acid alkyl amides were discovered and no unpublished data were submitted.

### **GENOTOXICITY**

In vitro and in vivo genotoxicity studies are presented in Table 6. In in vitro studies, acetyl glutamic acid, acetyl proline, acetyl tyrosinamide, disodium capryloyl glutamate, sodium cocoyl glutamate, and sodium lauroyl glutamate were negative for genotoxicity. Acetyl glutamic acid was negative in an in vivo study.

### **CARCINOGENICITY**

No published carcinogenicity studies on amino acid alkyl amides were discovered and no unpublished data were submitted.

### **IRRITATION AND SENSITIZATION**

*[From the CIR Safety Assessment of  $\alpha$ -amino acids]<sup>1</sup>: Cysteine HCl and methionine were used as negative controls in in vitro assays to predict potential skin irritants. In separate efficacy studies, arginine, cysteine, and glycine did not produce any adverse effects in rats, guinea pigs, or mouse skin models. Glutamic acid was used as a negative control in an in vitro study to identify skin sensitizers. HRIPT studies of many products containing amino acid ingredients concluded that products containing these ingredients were not dermal irritants or sensitizers. In several validation studies for in vitro phototoxicity assays, histidine was used as a negative control. Magnesium aspartate up to 0.5% and 1% tyrosine were not phototoxic in assays using yeast.*

#### **Irritation**

In vitro and human dermal irritation studies are presented in Table 7. No irritation was observed in in vitro studies with disodium capryloyl glutamate. Acetyl proline was a mild irritant in another in vitro study. In human studies, acetyl proline, acetyl tyrosinamide, disodium capryloyl glutamate, sodium cocoyl glutamate, and sodium lauroyl glutamate were not dermal irritants.

#### **Ocular**

Non-human and human ocular irritation studies are presented in Table 8. No ocular irritation was observed in in vitro studies of acetyl tyrosinamide, disodium capryloyl glutamate, and sodium lauroyl glutamate. Severe irritation was observed in 1 study of sodium cocoyl glutamate at 5%, but was not irritating in another study with an unknown concentration. No adverse effects were observed during in-use studies of acetyl hydroxyproline and acetyl tyrosinamide in human subjects.

### **Sensitization**

Non-human and human dermal sensitization studies are presented in Table 9. No sensitization was observed in human studies with acetyl hydroxyproline, acetyl proline, acetyl tyrosinamide, disodium capryloyl glutamate, sodium cocoyl glutamate, and sodium lauroyl glutamate.

#### Phototoxicity

Non-human and human phototoxicity studies are presented in Table 10. In non-human and human studies, acetyl tyrosinamide was not phototoxic. Sodium cocoyl glutamate and sodium lauroyl glutamate were not phototoxic in human studies.

### **CLINICAL USE**

No relevant published clinical use studies on amino acid alkyl amides were discovered and no unpublished data were submitted.

### **SUMMARY**

The 115 amino acid alkyl amides mainly function as skin and hair conditioning agents and as surfactants-cleansing agents in personal care products. These ingredients are comprised of amino acids acylated with acids or acid chlorides at the amino acid nitrogen to form amides. By and large, the ingredients in this report will rapidly dissociate in the presence of water. The relative exposure, hence, would be to amino acids and fatty acids, carboxylic acids, or dicarboxylic acids.

Lauroyl lysine has the most reported uses in cosmetic and personal care products, with a total of 604; most uses are in leave-on eye and facial makeup. Sodium cocoyl glutamate has the second greatest number of overall uses reported, with a total of 132; a little more than half of those uses are in rinse-off products. Lauroyl lysine is used up to concentrations of 45%, with the maximum concentration reported in lipsticks.

In the European Union, trialkylamines, trialkanolamines, and their salts (ingredients containing TEA) may only be used up to 2.5%, must be at least 99% pure, are not to be used with nitrosating systems, must have a maximum secondary amine content of 0.5%, must have a maximum nitrosamine content of 50 µg/kg, and must be kept in nitrite-free containers. The remaining ingredients are not restricted from use in any way under the rules governing cosmetic products in the European Union.

Amino acid alkyl amides are used in household detergents. The FDA has approved acetyl cysteine in drug therapies. Acetyl methionine is an approved dietary supplement.

In a study of 3 formulations containing 1.75% acetyl tyrosinamide, the test material was found to penetrate into and through ex vivo human skin.

In in vitro studies, acetyl glutamic acid, acetyl proline, acetyl tyrosinamide, disodium capryloyl glutamate, sodium cocoyl glutamate, and sodium lauroyl glutamate were negative for genotoxicity. Acetyl glutamic acid was negative in an in vivo study.

No dermal irritation was observed in in vitro studies with disodium capryloyl glutamate. Acetyl proline was a mild irritant in another in vitro study. In human studies, acetyl proline, acetyl tyrosinamide, disodium capryloyl glutamate, sodium cocoyl glutamate, and sodium lauroyl glutamate were not dermal irritants.

No ocular irritation was observed in in vitro studies of acetyl tyrosinamide, disodium capryloyl glutamate, and sodium lauroyl glutamate. Severe irritation was observed in 1 study of sodium cocoyl glutamate at 5%, but was not irritating in another study with an unknown concentration. No adverse effects were observed during in-use studies of acetyl hydroxyproline and acetyl tyrosinamide in human subjects.

No sensitization was observed in human studies with acetyl hydroxyproline, acetyl proline, acetyl tyrosinamide, disodium capryloyl glutamate, sodium cocoyl glutamate, and sodium lauroyl glutamate.

In non-human and human studies, acetyl tyrosinamide was not phototoxic. Sodium cocoyl glutamate and sodium lauroyl glutamate were not phototoxic in human studies.

No published reproductive and development toxicity, carcinogenicity, nor relevant clinical use studies on amino acid alkyl amides were discovered and no unpublished data were submitted

## TABLES AND FIGURES

**Table 1.** Definitions and functions of the Amino Acid Alkyl Amides in this safety assessment.<sup>17</sup> (Any italicized text below represents additions made by CIR staff.)

<b>Ingredient CAS No.</b>	<b>Definition</b>	<b>Function</b>
Acetyl Arginine 210545-23-6	Acetyl Arginine is the substituted amino acid that conforms to the formula. <i>Acetyl Arginine is the amide formed from the reaction of acetic acid chloride and arginine.</i>	humectants; skin-conditioning agents - emollient
Acetyl Cysteine 616-91-1	Acetyl Cysteine is the organic compound that conforms to the formula. <i>Acetyl Cysteine is the amide formed from the reaction of acetic acid chloride and cysteine.</i>	antioxidants; skin-conditioning agents – misc.
Acetyl Glutamic Acid 1188-37-0	Acetyl Glutamic Acid is the substituted amino acid that conforms to the formula. <i>Acetyl Glutamic Acid is the amide formed from the reaction of acetic acid chloride and glutamic acid.</i>	skin-conditioning agents – misc.
Acetyl Glutamine 2490-97-3 35305-74-9	Acetyl Glutamine is the organic compound that conforms to the formula. <i>Acetyl Glutamine is the amide formed from the reaction of acetic acid chloride and glutamine.</i>	skin-conditioning agents – misc.
Acetyl Histidine 39145-52-3	Acetyl Histidine is the organic compound that conforms to the formula. <i>Acetyl Histidine is the amide formed from the reaction of acetic acid chloride and histidine.</i>	skin-conditioning agents - emollient; skin-conditioning agents - humectant
Acetyl Methionine 1115-47-5 65-82-7	Acetyl Methionine is the substituted amino acid that conforms to the formula. <i>Acetyl Methionine is the amide formed from the reaction of acetic acid chloride and methionine.</i>	skin-conditioning agents- misc.
Acetyl Proline 68-95-1	Acetyl Proline is the substituted amino acid that conforms to the formula. <i>Acetyl Proline is the amide formed from the reaction of acetic acid chloride and proline.</i>	skin-conditioning agents- emollient
Acetyl Tyrosine 537-55-3	Acetyl Tyrosine is the organic compound that conforms to the formula. <i>Acetyl Tyrosine is the amide formed from the reaction of acetic acid chloride and tyrosine.</i>	skin-conditioning agents- misc.
Capryloyl Collagen Amino Acids	Capryloyl Collagen Amino Acids is the condensation product of caprylic acid chloride with Collagen Amino Acids.	hair conditioning agents; surfactants-cleansing agents
Capryloyl Glycine 14246-53-8	Capryloyl Glycine is the acylation product of glycine with caprylic acid chloride.	hair conditioning agents; surfactants-cleansing agents
Capryloyl Gold of Pleasure Amino Acids	Capryloyl Gold of Pleasure Amino Acids is the condensation product of caprylic acid chloride and the amino acids derived from the complete hydrolysis of the protein fraction obtained from the seeds of <i>Camelina sativa</i> .	cosmetic biocides; deodorant agents
Capryloyl Keratin Amino Acids	Capryloyl Keratin Amino Acids is the condensation product of caprylic acid chloride with Keratin Amino Acids.	hair conditioning agents; surfactants-cleansing agents
Capryloyl Pea Amino Acids	Capryloyl Pea Amino Acids is the product obtained by the condensation of caprylic acid chloride and pea amino acids.	hair conditioning agents; skin-conditioning agents- misc.
Capryloyl Quinoa Amino Acids	Capryloyl Quinoa Amino Acids is the condensation product of caprylic acid chloride and amino acids obtained from the complete hydrolysis of the protein obtained from the seeds of <i>Chenopodium quinoa</i> .	hair conditioning agents; skin-conditioning agents- misc.
Capryloyl Silk Amino Acids	Capryloyl Silk Amino Acids is the product obtained by the condensation of caprylic acid chloride with Silk Amino Acids.	hair conditioning agents; surfactants-cleansing agents
Cocoyl Glutamic Acid	Cocoyl Glutamic Acid is the Coconut Acid amide of Glutamic Acid that conforms to the formula.	hair conditioning agents; skin-conditioning agents- misc.; surfactants-cleansing agents
Dipalmitoyl Cystine 17627-10-0	Dipalmitoyl Cystine is the product obtained by acylation of cystine with palmitoyl chloride.	hair conditioning agents
Dipotassium Capryloyl Glutamate	Dipotassium Capryloyl Glutamate is the organic compound that conforms to the formula. <i>Dipotassium Capryloyl Glutamate is the dipotassium salt of the amide formed from the reaction of capryloyl chloride and glutamic acid.</i>	deodorant agents; surfactants-cleansing agents
Dipotassium Undecylenoyl Glutamate	Dipotassium Undecylenoyl Glutamate is the substituted amino acid that conforms to the formula. <i>Dipotassium Undecylenoyl Glutamate is the dipotassium salt of the amide formed from the reaction of undecylenoyl chloride and glutamic acid.</i>	hair conditioning agents; skin-conditioning agents- misc.; surfactants-cleansing agents
Disodium Capryloyl Glutamate	Disodium Capryloyl Glutamate is the organic compound that conforms to the formula. <i>Disodium Capryloyl Glutamate is the disodium salt of the amide formed from the reaction of capryloyl chloride and glutamic acid.</i>	deodorant agents; surfactants-cleansing agents



**Table 1.** Definitions and functions of the Amino Acid Alkyl Amides in this safety assessment.<sup>17</sup> (Any italicized text below represents additions made by CIR staff.)

<b>Ingredient CAS No.</b>	<b>Definition</b>	<b>Function</b>
Disodium Cocoyl Glutamate 68187-30-4	Disodium Cocoyl Glutamate is the disodium salt of the coconut acid amide of glutamic acid. It conforms generally to the formula.	surfactants-cleansing agents
Disodium Hydrogenated Tallow Glutamate	Disodium Hydrogenated Tallow Glutamate is the disodium salt of the hydrogenated tallow acid amide of Glutamic Acid. It conforms generally to the formula.	hair conditioning agents; skin-conditioning agents-misc.; surfactants-cleansing agents
Disodium N-Lauroyl Aspartate	Disodium N-Lauroyl Aspartate is the organic compound that conforms to the formula. <i>Disodium N-Lauroyl Aspartate is the disodium salt of the amide formed from the reaction of lauroyl chloride and aspartic acid.</i>	surfactants-cleansing agents
Disodium Lauroyl Glutamate	Disodium Lauroyl Glutamate is the organic compound that conforms to the formula. <i>Disodium Lauroyl Glutamate is the disodium salt of the amide formed from the reaction of lauroyl chloride and glutamic acid.</i>	hair conditioning agents; skin-conditioning agents-misc.; surfactants-cleansing agents
Disodium Malyl Tyrosinate 126139-79-5	Disodium Malyl Tyrosinate is the organic compound that conforms to the formula. <i>Disodium Malyl Tyrosinate is the disodium salt of the amide formed from the reaction of malyl chloride and tyrosine.</i>	skin-conditioning agents-misc.
Disodium Stearoyl Glutamate 38079-62-8	Disodium Stearoyl Glutamate is the organic compound that conforms to the formula. <i>Disodium Stearoyl Glutamate is the disodium salt of the amide formed from the reaction of stearoyl chloride and glutamic acid.</i>	hair conditioning agents; skin-conditioning agents-misc.; surfactants-cleansing agents
Disodium Undecylenoyl Glutamate	Disodium Undecylenoyl Glutamate is the substituted amino acid that conforms to the formula. <i>Disodium Undecenoyl Glutamate is the disodium salt of the amide formed from the reaction of undecenoyl chloride and glutamic acid.</i>	hair conditioning agents; skin-conditioning agents-misc.; surfactants-cleansing agents
Lauroyl Arginine 42492-22-8	Lauroyl Arginine is the substituted amino acid that conforms to the formula. <i>Lauroyl Arginine is the amide formed from the reaction of lauroyl chloride and arginine.</i>	hair conditioning agents; skin-conditioning agents-emollient
Lauroyl Collagen Amino Acids 68920-59-2	Lauroyl Collagen Amino Acids is the product obtained by the condensation of lauric acid chloride with Collagen Amino Acids.	hair conditioning agents; surfactants-cleansing agents
Lauroyl Glutamic Acid 3397-65-7	Lauroyl Glutamic Acid is the substituted amino acid that conforms to the formula. <i>Lauroyl Glutamic Acid is the amide formed from the reaction of lauroyl chloride and glutamic acid.</i>	skin-conditioning agents-misc.
Lauroyl Lysine 52315-75-0	Lauroyl Lysine is the lauroyl derivative of Lysine that conforms to the formula. <i>Lauroyl Lysine is the amide formed from the reaction of lauroyl chloride and lysine.</i>	hair conditioning agents; skin-conditioning agents-misc.
Lauroyl Proline 58725-39-6	Lauroyl Proline is the organic compound that conforms to the formula. <i>Lauroyl Proline is the amide formed from the reaction of lauroyl chloride and proline.</i>	hair conditioning agents; skin-conditioning agents – misc.
Lauroyl Silk Amino Acids	Lauroyl Silk Amino Acids is the product obtained by the condensation of lauric acid chloride and Silk Amino Acids.	hair conditioning agents; surfactants-cleansing agents
Magnesium Palmitoyl Glutamate 57539-47-6	Magnesium Palmitoyl Glutamate is the substituted amino acid that conforms to the formula. <i>Magnesium Palmitoyl Glutamate is the magnesium salt of the amide formed from the reaction of palmitoyl chloride and glutamic acid.</i>	skin-conditioning agents - misc.
Myristoyl Glutamic Acid	Myristoyl Glutamic Acid is the substituted amino acid that conforms to the formula. <i>Myristoyl Glutamic Acid is the amide formed from the reaction of myristoyl chloride and glutamic acid.</i>	hair conditioning agents; skin-conditioning agents-misc.; surfactants-cleansing agents
Oleoyl Tyrosine	Oleoyl Tyrosine is the organic compound that conforms to the formula. <i>Oleoyl Tyrosine is the amide formed from the reaction of oleoyl chloride and tyrosine.</i>	skin-conditioning agents-misc.
Palmitoyl Alanine 56255-31-3	Palmitoyl Alanine is the substituted amino acid that conforms to the formula. <i>Palmitoyl Alanine is the amide formed from the reaction of palmitoyl chloride and alanine.</i>	skin protectants
Palmitoyl Arginine 58725-47-6	Palmitoyl Arginine is the organic compound that conforms to the formula. <i>Palmitoyl Arginine is the amide formed from the reaction of palmitoyl chloride and arginine..</i>	hair conditioning agents; skin-conditioning agents-emollient
Palmitoyl Collagen Amino Acids	Palmitoyl Collagen Amino Acids is the condensation product of palmitic acid chloride and Collagen Amino Acids.	hair conditioning agents; skin-conditioning agents-misc.; surfactants-cleansing agents

**Table 1.** Definitions and functions of the Amino Acid Alkyl Amides in this safety assessment.<sup>17</sup> (Any italicized text below represents additions made by CIR staff.)

<b>Ingredient CAS No.</b>	<b>Definition</b>	<b>Function</b>
Palmitoyl Glutamic Acid 38079-66-2	Palmitoyl Glutamic Acid is the substituted amino acid that conforms to the formula. <i>Palmitoyl Glutamic Acid is the amide formed from the reaction of palmitoyl chloride and glutamic acid.</i>	skin-conditioning agents-misc.
Palmitoyl Glycine 2441-41-0	Palmitoyl Glycine is the acylation product of glycine with palmitic acid chloride.	hair conditioning agents; surfactants-cleansing agents
Palmitoyl Gold of Pleasure Amino Acids	Palmitoyl Gold of Pleasure Amino Acids is the condensation product of palmitic acid chloride and the amino acids obtained from the complete hydrolysis of the protein fraction derived from the seeds of gold of pleasure.	hair conditioning agents; skin-conditioning agents-emollient
Palmitoyl Isoleucine 54617-29-7	Palmitoyl Isoleucine is the substituted amino acid that conforms to the formula. <i>Palmitoyl Isoleucine is the amide formed from the reaction of palmitoyl chloride and isoleucine.</i>	skin protectants
Palmitoyl Keratin Amino Acids	Palmitoyl Keratin Amino Acids is the condensation product of palmitic acid chloride and Keratin Amino Acids.	hair conditioning agents; skin-conditioning agents-misc.; surfactants-cleansing agents
Palmitoyl Millet Amino Acids	Palmitoyl Millet Amino Acids is the condensation product of palmitic acid chloride and the amino acids obtained from the complete hydrolysis of the protein fraction of <i>Panicum miliaceum</i> .	hair conditioning agents; skin-conditioning agents-emollient
Palmitoyl Oat Amino Acids	Palmitoyl Oat Amino Acids is the condensation product of palmitic acid chloride and the amino acids obtained from the complete hydrolysis of the protein fraction of <i>Avena sativa</i> (Oat).	hair conditioning agents; skin-conditioning agents-emollient
Palmitoyl Pea Amino Acids	Palmitoyl Pea Amino Acids is the condensation product of palmitic acid chloride and pea amino acids.	hair conditioning agents; skin-conditioning agents-misc.
Palmitoyl Proline 59441-32-6	Palmitoyl Proline is the product obtained by the condensation of palmitic acid chloride with Proline.	none reported
Palmitoyl Quinoa Amino Acids	Palmitoyl Quinoa Amino Acids is the condensation product of palmitic acid chloride and the amino acids obtained from the complete hydrolysis of the protein fraction derived from the seeds of <i>Chenopodium quinoa</i> .	hair conditioning agents; skin-conditioning agents-misc.
Palmitoyl Silk Amino Acids	Palmitoyl Silk Amino Acids is the condensation product of palmitic acid chloride and Silk Amino Acids.	hair conditioning agents; surfactants-cleansing agents
Potassium Caproyl Tyrosine	Potassium Caproyl Tyrosine is the organic compound that conforms to the formula. <i>Potassium Caproyl Tyrosine is the potassium salt of the amide formed from the reaction of caproyl chloride and tyrosine.</i>	skin-conditioning agents - misc
Potassium Capryloyl Glutamate	Potassium Capryloyl Glutamate is the substituted amino acid that conforms to the formula. <i>Potassium Capryloyl Glutamate is the potassium salt of the amide formed from the reaction of capryloyl chloride and glutamic acid.</i>	deodorant agents; surfactants-cleansing agents
Potassium Cocoyl Glutamate	Potassium Cocoyl Glutamate is the mixed potassium salts of the coconut acid amide of glutamic acid. It conforms generally to the formula.	hair conditioning agents; surfactants-cleansing agents
Potassium Cocoyl Glycinate 301341-58-2	Potassium Cocoyl Glycinate is the organic compound that conforms to the formula. <i>Potassium Cocoyl Glycinate is the potassium salt of the amide formed from the reaction of coconut acid chloride and glycine.</i>	hair conditioning agents; surfactants-cleansing agents
Potassium Cocoyl Rice Amino Acids	Potassium Cocoyl Rice Amino Acids is the potassium salt of the product obtained by the reaction of coconut acid chloride with Rice Amino Acids.	skin-conditioning agents - emollient; skin-conditioning agents - misc.; surfactants - emulsifying agents; surfactants - foam boosters
Potassium Lauroyl Collagen Amino Acids	Potassium Lauroyl Collagen Amino Acids is the potassium salt of the condensation product of lauric acid chloride and Collagen Amino Acids.	hair conditioning agents; skin-conditioning agents-misc.; surfactants-cleansing agents
Potassium Lauroyl Glutamate 89187-78-0 (L-)	Potassium Lauroyl Glutamate is the substituted amino acid that conforms to the formula. <i>Potassium Lauroyl Glutamate is the potassium salt of the amide formed from the reaction of lauroyl chloride and glutamic acid.</i>	hair conditioning agents; surfactants-cleansing agents
Potassium Lauroyl Oat Amino Acids	Potassium Lauroyl Oat Amino Acids is the potassium salt of the product obtained by the reaction of lauroyl chloride and Oat Amino Acids.	hair conditioning agents
Potassium Lauroyl Pea Amino Acids	Potassium Lauroyl Pea Amino Acids is the potassium salt of the reaction product of lauric acid chloride with the amino acids derived from the seeds of <i>Pisum sativum</i> .	hair conditioning agents; skin-conditioning agents-misc.; surfactants-cleansing agents

**Table 1.** Definitions and functions of the Amino Acid Alkyl Amides in this safety assessment.<sup>17</sup> (Any italicized text below represents additions made by CIR staff.)

<b>Ingredient CAS No.</b>	<b>Definition</b>	<b>Function</b>
Potassium Lauroyl Silk Amino Acids	Potassium Lauroyl Silk Amino Acids is the potassium salt of the condensation product of lauric acid chloride and Silk Amino Acids.	hair conditioning agents; skin-conditioning agents - misc.; surfactants - cleansing agents
Potassium Lauroyl Wheat Amino Acids	Potassium Lauroyl Wheat Amino Acids is the potassium salt of the condensation product of lauric acid chloride and Wheat Amino Acids.	hair conditioning agents; skin-conditioning agents - misc.; surfactants - cleansing agents
Potassium Myristoyl Glutamate	Potassium Myristoyl Glutamate is the potassium salt of the myristic acid amide of glutamic acid. It conforms to the formula.	hair conditioning agents; surfactants-cleansing agents
Potassium Olivoyl/Lauroyl Wheat Amino Acids	Potassium Olivoyl/Lauroyl Wheat Amino Acids is the potassium salt of the condensation product of olivoyl chloride, lauroyl chloride, and Wheat Amino Acids.	surfactants-cleansing agents
Potassium Stearoyl Glutamate	Potassium Stearoyl Glutamate is the potassium salt of Stearoyl Glutamic Acid. <i>Potassium Stearoyl Glutamate is the potassium salt of the amide formed from the reaction of stearoyl chloride and glutamic acid.</i>	hair conditioning agents; skin-conditioning agents - misc.
Potassium Undecylenoyl Glutamate	Potassium Undecylenoyl Glutamate is the substituted amino acid that conforms to the formula. <i>Potassium Undecylenoyl Glutamate is the potassium salt of the amide formed from the reaction of undecylenoyl chloride and glutamic acid.</i>	abrasives; hair conditioning agents
Propionyl Collagen Amino Acids	Propionyl Collagen Amino Acids is the condensation product of propionic acid chloride with Collagen Amino Acids.	skin-conditioning agents - occlusive
Sodium Caproyl Prolinate 1364318-34-2	Sodium Caproyl Prolinate is the organic compound that conforms to the formula. <i>Sodium Caproyl Prolinate is the sodium salt of the amide formed from the reaction of caproyl chloride and proline.</i>	hair conditioning agents; skin-conditioning agents - humectant; surfactants - cleansing agents
Sodium Capryloyl Glutamate	Sodium Capryloyl Glutamate is the substituted amino acid that conforms to the formula. <i>Sodium Capryloyl Glutamate is the sodium salt of the amide formed from the reaction of capryloyl chloride and glutamic acid.</i>	deodorant agents; surfactants-cleansing agents
Sodium Cocoyl Alaninate 90170-45-9	Sodium Cocoyl Alaninate is the organic compound that conforms to the formula. <i>Sodium Cocoyl Alaninate is the sodium salt of the amide formed from the reaction of coconut acid chloride and alanine.</i>	hair conditioning agents; surfactants-cleansing agents
Sodium Cocoyl Amino Acids	Sodium Cocoyl Amino Acids is the sodium salt of a mixture of amino acids acylated by cocoyl chloride.	surfactants-cleansing agents
Sodium Cocoyl Apple Amino Acids	Sodium Cocoyl Apple Amino Acids is the sodium salt of the condensation product of coconut acid chloride and the amino acids obtained by the complete hydrolysis of the protein fraction isolated from the seeds of <i>Pyrus malus</i> .	hair conditioning agents; skin-conditioning agents - misc.; surfactants - cleansing agents
Sodium Cocoyl Barley Amino Acids	Sodium Cocoyl Barley Amino Acids is the sodium salt of the condensation product of coconut acid chloride and the amino acids derived from barley protein.	emulsion stabilizers; skin-conditioning agents – misc.; surfactants - emulsifying agents
Sodium Cocoyl Collagen Amino Acids	Sodium Cocoyl Collagen Amino Acids is the sodium salt of the condensation product of coconut acid chloride and Collagen Amino Acids.	hair conditioning agents; surfactants-cleansing agents
Sodium Cocoyl Glutamate 68187-32-6	Sodium Cocoyl Glutamate is the sodium salt of Cocoyl Glutamic Acid. It conforms generally to the formula. <i>Sodium Cocoyl Glutamate is the sodium salt of the amide formed from the reaction of coconut acid chloride and glutamic acid.</i>	surfactants-cleansing agents
Sodium Cocoyl Glutamate	Sodium Cocoyl Glutamate is the organic compound that conforms to the formula. <i>Sodium Cocoyl Glutamate is the sodium salt of the amide formed from the reaction of coconut acid chloride and glutamine.</i>	surfactants- cleansing agents
Sodium Cocoyl Glycinate 90387-74-9	Sodium Cocoyl Glycinate is the organic compound that conforms generally to the formula. <i>Sodium Cocoyl Glycinate is the sodium salt of the amide formed from the reaction of coconut acid chloride and glycine.</i>	hair conditioning agents; skin-conditioning agents - misc.; surfactants - cleansing agents
Sodium Cocoyl/Hydrogenated Tallow Glutamate	Sodium Cocoyl/Hydrogenated Tallow Glutamate is the organic compound that conforms generally to the formula. <i>Sodium Cocoyl/Hydrogenated Tallow Glutamate is the sodium salt of the mixture of cocoyl acid amides and hydrogenated tallow acid amides of glutamic acid.</i>	surfactants-cleansing agents
Sodium Cocoyl Oat Amino Acids	Sodium Cocoyl Oat Amino Acids is the sodium salt of the condensation product of coconut acid chloride and the amino acids derived from Avena Sativa (Oat) Protein.	hair conditioning agents; skin-conditioning agents - misc.; surfactants - cleansing agents

**Table 1.** Definitions and functions of the Amino Acid Alkyl Amides in this safety assessment.<sup>17</sup> (Any italicized text below represents additions made by CIR staff.)

<b>Ingredient CAS No.</b>	<b>Definition</b>	<b>Function</b>
Sodium Cocoyl/Palmoyl/Sunfloweroyl Glutamate	Sodium Cocoyl/Palmoyl/Sunfloweroyl Glutamate is the sodium salt of the product formed by the reaction of Glutamic Acid with a mixture of Coconut Acid, Palm Acid and Sunflower Seed Acid.	surfactants-cleansing agents; surfactants-emulsifying agents
Sodium Cocoyl Proline	Sodium Cocoyl Proline is the substituted amino acid that conforms to the formula. <i>Sodium Cocoyl Proline is the sodium salt of the amide formed from the reaction of coconut acid chloride and proline.</i>	surfactants-cleansing agents; surfactants-solubilizing agents
Sodium Cocoyl Threoninate	Sodium Cocoyl Threoninate is the organic compound that conforms to the formula. <i>Sodium Cocoyl Threoninate is the sodium salt of the amide formed from the reaction of coconut acid chloride and threonine.</i>	surfactants-cleansing agents; surfactants-emulsifying agents
Sodium Cocoyl Wheat Amino Acids	Sodium Cocoyl Wheat Amino Acids is the sodium salt of the condensation product of coconut acid chloride and the amino acids derived from Triticum Vulgare (Wheat) Protein.	hair conditioning agents; skin-conditioning agents-misc.; surfactants-cleansing agents
Sodium Hydrogenated Tallowoyl Glutamate	Sodium Hydrogenated Tallowoyl Glutamate is the sodium salt of the hydrogenated tallow acid amide of glutamic acid. It conforms generally to the formula.	surfactants-cleansing agents
Sodium Lauroyl Aspartate 41489-18-3	Sodium Lauroyl Aspartate is the organic compound that conforms to the formula. <i>Sodium Lauroyl Aspartate is the sodium salt of the amide formed from the reaction of lauroyl chloride and aspartic acid.</i>	hair conditioning agents; surfactants-cleansing agents
Sodium Lauroyl Collagen Amino Acids	Sodium Lauroyl Collagen Amino Acids is the sodium salt of the condensation product of lauric acid chloride and Collagen Amino Acids.	hair conditioning agents; surfactants-cleansing agents
Sodium Lauroyl Glutamate 29923-31-7 (L-) 29923-34-0 (DL-) 42926-22-7 (L-) 98984-78-2	Sodium Lauroyl Glutamate is the sodium salt of the lauric acid amide of glutamic acid. It conforms generally to the formula.	hair conditioning agents
Sodium Lauroyl Millet Amino Acids	Sodium Lauroyl Millet Amino Acids is the sodium salt of the condensation product of lauric acid chloride and the amino acids obtained by the complete hydrolysis of the protein fraction of <i>Panicum miliaceum</i> .	surfactants-cleansing agents
Sodium Lauroyl/Myristoyl Aspartate	Sodium Lauroyl/Myristoyl Aspartate is the sodium salt of the substituted amino acid that conforms generally to the formula. <i>Sodium Lauroyl/Myristoyl Aspartate is the sodium salt of the amide formed from the reaction of a mixture of lauroyl chloride and myristoyl chloride with aspartic acid.</i>	hair conditioning agents; surfactants-cleansing agents
Sodium Lauroyl Oat Amino Acids	Sodium Lauroyl Oat Amino Acids is the sodium salt of the condensation product of lauric acid chloride with the amino acids derived from Avena Sativa (Oat) Kernel Protein.	hair conditioning agents; skin-conditioning agents-misc.; surfactants-cleansing agents
Sodium Lauroyl Silk Amino Acids	Sodium Lauroyl Silk Amino Acids is the sodium salt of the condensation product of lauric acid chloride and Silk Amino Acids.	hair conditioning agents; skin-conditioning agents-misc.; surfactants-cleansing agents
Sodium Lauroyl Wheat Amino Acids	Sodium Lauroyl Wheat Amino Acids is the sodium salt of the condensation product of lauric acid chloride and Wheat Amino Acids.	hair conditioning agents; skin-conditioning agents-misc.; surfactants-cleansing agents
Sodium Myristoyl Glutamate 38517-37-2 38754-83-5 (DL-) 71368-20-2	Sodium Myristoyl Glutamate is the sodium salt of the myristic acid amide of glutamic acid. It conforms generally to the formula.	surfactants-cleansing agents
Sodium Olivoyl Glutamate	Sodium Olivoyl Glutamate is the sodium salt of olivoyl glutamic acid. It conforms generally to the formula. <i>Sodium Olivoyl Glutamate is the sodium salt of the amide formed from the reaction of olivoyl chloride and glutamic acid.</i>	surfactants-cleansing agents
Sodium Palmitoyl Proline 58725-33-0	Sodium Palmitoyl Proline is the substituted amino acid that conforms to the formula. <i>Sodium Palmitoyl Proline is the sodium salt of the amide formed from the reaction of palmitoyl chloride and proline.</i>	skin-conditioning agents-misc.
Sodium Palmoyl Glutamate	Sodium Palmoyl Glutamate is the sodium salt of palmoyl glutamic acid. It conforms generally to the formula. <i>Sodium Palmoyl Glutamate is the sodium salt of the amide formed from the reaction of palm acid chloride and glutamic acid.</i>	surfactants-cleansing agents

**Table 1.** Definitions and functions of the Amino Acid Alkyl Amides in this safety assessment.<sup>17</sup> (Any italicized text below represents additions made by CIR staff.)

<b>Ingredient CAS No.</b>	<b>Definition</b>	<b>Function</b>
Sodium Stearoyl Glutamate 38517-23-6 79811-24-8 (L-)	Sodium Stearoyl Glutamate is the organic compound that conforms to the formula. <i>Sodium Stearoyl Glutamate is the sodium salt of the amide formed from the reaction of stearoyl chloride and glutamic acid.</i>	hair conditioning agents; skin-conditioning agents- misc.; surfactants- cleansing agents
Sodium/TEA-Lauroyl Collagen Amino Acids	Sodium/TEA-Lauroyl Collagen Amino Acids is a mixture of sodium and triethanolamine salts of the condensation product of lauric acid chloride and Collagen Amino Acids.	hair conditioning agents; surfactants-cleansing agents
Sodium/TEA-Lauroyl Keratin Amino Acids	Sodium/TEA-Lauroyl Keratin Amino Acids is a mixture of sodium and triethanolamine salts of the condensation product of lauric acid chloride and Keratin Amino Acids.	hair conditioning agents; surfactants-cleansing agents
Sodium/TEA-Undecylenoyl Collagen Amino Acids	Sodium/TEA-Undecylenoyl Collagen Amino Acids is a mixture of sodium and triethanolamine salts of the condensation product of undecylenic acid chloride and Collagen Amino Acids.	hair conditioning agents; surfactants-cleansing agents
Sodium Undecylenoyl Glutamate	Sodium Undecylenoyl Glutamate is the substituted amino acid that conforms generally to the formula. <i>Sodium Undecylenoyl Glutamate is the sodium salt of the amide formed from the reaction of undecylenoyl chloride and glutamic acid.</i>	hair conditioning agents; skin-conditioning agents- misc.; surfactants- cleansing agents
Stearoyl Glutamic Acid 3397-16-8	Stearoyl Glutamic Acid is the substituted amino acid that conforms to the formula. <i>Stearoyl Glutamic Acid is the amide formed from the reaction of stearoyl chloride and glutamic acid.</i>	hair conditioning agents; skin-conditioning agents- misc.; surfactants- cleansing agents
Stearoyl Leucine 14379-43-2	Stearoyl Leucine is the stearoyl derivative of leucine that conforms to the formula. <i>Stearoyl Leucine is the amide formed from the reaction of stearoyl chloride and leucine.</i>	hair conditioning agents; skin-conditioning agents- misc.; surfactants- emulsifying agents
TEA-Cocoyl Alaninate	TEA-Cocoyl Alaninate is the triethanolamine salt of the coconut acid amide of alanine. It conforms generally to the formula.	hair conditioning agents; surfactants-cleansing agents
TEA-Cocoyl Glutamate 68187-29-1	TEA-Cocoyl Glutamate is the triethanolamine salt of the coconut acid amide of glutamic acid. It conforms generally to the formula.	hair conditioning agents; surfactants-cleansing agents
TEA-Cocoyl Glutamate	TEA-Cocoyl Glutamate is the triethanolamine salt of the coconut acid amide of glutamic acid. It conforms generally to the formula.	surfactants-cleansing agents
TEA-Cocoyl Glutamine	TEA-Cocoyl Glutamine is the organic compound that conforms to the formula. <i>TEA-Cocoyl Glutamine is the triethanolamine salt of the coconut acid amide of glutamine.</i>	surfactants-cleansing agents
TEA-Hydrogenated Tallowoyl Glutamate	TEA-Hydrogenated Tallowoyl Glutamate is the triethanolamine salt of the hydrogenated tallow acid amide of glutamic acid. It conforms generally to the formula.	hair conditioning agents; surfactants-cleansing agents
TEA-Lauroyl Collagen Amino Acids	TEA-Lauroyl Collagen Amino Acids is the triethanolamine salt of the condensation product of lauric acid chloride and Collagen Amino Acids.	hair conditioning agents; surfactants-cleansing agents
TEA-Lauroyl Glutamate 31955-67-6 53576-49-1	TEA-Lauroyl Glutamate is the triethanolamine salt of the lauric acid amide of glutamic acid. It conforms generally to the formula.	hair conditioning agents; surfactants-cleansing agents
TEA-Lauroyl Keratin Amino Acids	TEA-Lauroyl Keratin Amino Acids is the triethanolamine salt of the condensation product of lauric acid chloride and Keratin Amino Acids.	hair conditioning agents; surfactants-cleansing agents
TEA-Lauroyl/Myristoyl Aspartate	TEA-Lauroyl/Myristoyl Aspartate is the triethanolamine salt of the substituted amino acid that conforms generally to the formula	hair conditioning agents; surfactants-cleansing agents
Undecylenoyl Collagen Amino Acids	Undecylenoyl Collagen Amino Acids is the condensation product of undecylenoyl acid chloride and Collagen Amino Acids.	surfactants-cleansing agents
Undecylenoyl Glycine	Undecylenoyl Glycine is the acylation product of glycine with undecylenic acid chloride. It conforms to the formula.	hair conditioning agents; surfactants-cleansing agents
Undecylenoyl Phenylalanine 175357-18-3	Undecylenoyl Phenylalanine is the substituted amino acid that conforms to the formula. <i>Undecylenoyl Phenylalanine is the amide formed from the reaction of undecylenoyl chloride and phenylalanine.</i>	skin protectants; skin- conditioning agents-misc.
Undecylenoyl Wheat Amino Acids	Undecylenoyl Wheat Amino Acids is the condensation product of undecylenic acid chloride and Wheat Amino Acids.	hair conditioning agents; surfactants-cleansing agents
Zinc Lauroyl Aspartate 899426-42-7	Zinc Lauroyl Aspartate is the organic compound that conforms to the formula. <i>Zinc Lauroyl Aspartate is the zinc salt of the amide formed from the reaction of lauroyl chloride and aspartic acid.</i>	binders; surface modifiers

**Table 2.** Constituent acids with CIR conclusions

Constituent	Conclusion (year issued; maximum use concentration reported)	Summary of Findings	Reference
Acetic Acid	Safe as used (2012; 0.0004% in leave-ons; 0.3% in rinse-offs)	Central nervous system depression has been documented in animals exposed to acetic acid. Acetic acid has been labeled as a minor skin irritant, at low concentrations, in animal and human studies, and a severe ocular irritant in a rabbit ocular irritation test. The sodium salt of acetic acid has a more than 2-fold higher toleration level than the pure free acid, and acetic acid is not mutagenic when buffered to physiological pH.	5
Coconut Acid	safe as used (2011; not reported in leave-ons; 14% in rinse-offs)	The safety focus of use of the plant-derived fatty acid oils was on the potential for irritation and sensitization since the cosmetic ingredients reviewed were also found in the foods that are consumed daily. 5% aq. solutions of a bar soap containing 13% sodium cocoate had irritation scores of 1.6-4.0/8 in animal studies. However, the remaining animal and clinical irritation and/or sensitization studies conducted on a large number of the oils included in this report, primarily in formulation, did not report any significant irritation or sensitization reactions, indicating that refined oils derived from plants are not dermal irritants or sensitizers.	2-4
Dicarboxylic Acids	Safe as used (2012; 0.4% in leave-ons; 26% in rinse-offs/diluted for use)	The oral LD <sub>50</sub> values of the dicarboxylic acids had a wide range; for example, adipic acid had values in rats ranging from 0.94 g/kg to greater than the highest dose tested (11 g/kg). Most reported values for the acids were >2 g/kg. The reported dermal LD <sub>50</sub> values were >6 g/kg. Dietary administration of ≤3400 mg/kg bw/day adipic acid for 19 wks produced slight effects in male rat livers; the NOAEL was 3333 mg/kg bw. In another study, slight effects were seen in the livers of rats fed ≤3200 mg/kg bw/day adipic acid for 33 wks, and the NOAEL for rats fed a diet containing adipic acid for 2 yrs was 1%; no significant toxicological effects were seen at concentrations of ≤5%. Glutaric acid had a low degree of toxicity to rats (at 2%) and dogs (concentration not specified) when given in the feed. A mixture of adipic, glutaric, and succinic acids had a low degree of toxicity in rats when tested at 3% for 90-days. No significant toxicological effects were observed for mice fed ≤280 mg/kg bw or rabbits fed ≤400 mg/kg bw azelaic acid for 180 days. Disodium sebacate was not toxic to rats or rabbits fed up to 1000 mg/kg bw for 6 mos. Repeated dose inhalation exposure to 126 mg/m <sup>3</sup> adipic acid to rats did not produce signs of toxicity, but exposure of mice to concentrations as low as 13 mg/m <sup>3</sup> resulted in signs of toxicity. For the dicarboxylic acids, the severity of ocular irritation seems to decrease with increasing carbon number. Slight to mild dermal irritation was observed in rabbits for succinic, glutaric, and adipic acid, while dodecanedioic acid was not an irritant in rabbits. In guinea pigs, dicarboxylic acids were not sensitizers. Reproductive and developmental effects were not seen upon oral dosing with the dicarboxylic acids. Malonic acid, at 0.1% <i>in vitro</i> , has a spermicidal effect on human spermatozoa. Embryotoxic effects were reported in a reproductive study of 2500 mg/kg bw/day azelaic acid using rats and in reproductive studies with ≤500 mg/kg bw/day azelaic acid using rabbits and monkey. <i>In vitro</i> , sodium salts of some dicarboxylic acid had a specific inhibitory effect on muscle activity of the uterine horn, and this effect progressively increased with chain length. The dicarboxylic acids are not genotoxic, and consistently were not mutagenic in Ames tests. The dicarboxylic acids were not genotoxic in <i>in vivo</i> assays. Carcinogenicity was not seen in rats given up to 2% sodium succinate in the drinking water and 5% adipic acid in feed for 2 yrs. In a cumulative irritancy test, the cumulative irritation of a 15% azelaic acid gel increased with successive patching. It is not known if the vehicle played a role in the irritation scores. Daily application of a 20% azelaic cream caused erythema and irritation.	6

**Table 2.** Constituent acids with CIR conclusions

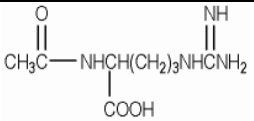
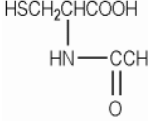
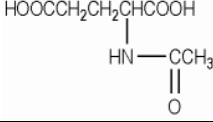
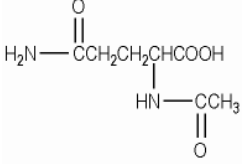
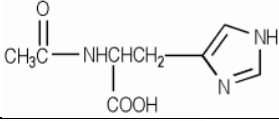
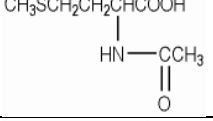
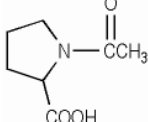
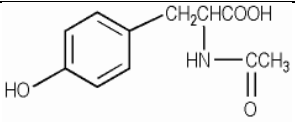
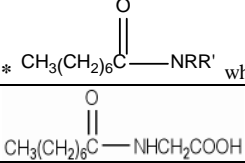
Lauric Acid	safe as used (1987; reaffirmed in 2006; 10% in leave-ons, 25% in rinse-offs)	Oleic, lauric, palmitic, and stearic acids are fatty acids with hydrocarbon chains ranging in length from 12 to 18 carbons with a terminal carboxyl group. These fatty acids are absorbed, digested, and transported in animals and humans. Little acute toxicity was observed when oleic, lauric, palmitic, or stearic acid or cosmetic formulations containing these fatty acids were given to rats orally at doses of 15-19 g/kg body weight. Feeding of 15% dietary oleic acid to rats in a chronic study resulted in normal growth and health, but reproductive capacity of female rats was impaired. Results from topical application of oleic, palmitic, and stearic acid to the skin of mice, rabbits, and guinea pigs produced little or no apparent toxicity. Studies using product formulations containing oleic and stearic acids indicate that neither is a sensitizer or photosensitizing agent. Animal studies also indicate that these fatty acids are not eye irritants. Lauric, stearic, and oleic acids were noncarcinogenic in separate animal tests. In primary and cumulative irritation clinical studies, oleic and stearic acids at high concentrations were nonirritating. Cosmetic product formulations containing oleic, lauric, palmitic, and stearic acids at concentrations ranging up to 13% were not primary or cumulative irritants, nor sensitizers.	7,8
Malic Acid	Insufficient data (2001; 1% in leave-ons and rinse-offs)	Malic acid is a direct food additive. In oral and IP tests with radioactive malic acid, most of the radioactivity was excreted as carbon dioxide. Oral LD <sub>50</sub> values for mice, rats, and rabbits ranged from 2.66 to > 3.2, 1.60 to 3.5, and 3 to 5 g/kg, respectively. The intravenous LD <sub>50</sub> value in rabbits was 2.4 g/kg and the intraperitoneal LD <sub>50</sub> values in mice and rats were 50 to 100 and 100 to 200 mg/kg, respectively. In repeated dose oral studies, rats fed malic acid had some changes in body weight gains and feed consumption, but no compound-related lesions were observed. No significant changes or lesions were observed in dogs fed malic acid repeatedly. Malic acid did not cause reproductive toxicity in mice, rats, or rabbits. Malic acid was moderately irritating to rabbit skin and was a strong irritant in guinea pigs. It also caused severe ocular irritation in rabbit eyes. Malic acid was not mutagenic in plate test, an Ames test, a suspension test, or a chromosomal aberration assay. In one study, pyrolyzates of malic acid were not mutagenic, but in another study they were. Products formed from treatment of malic acid with aqueous solutions of chlorine were mutagenic. In a test determining the subjective skin irritation potential, the average irritation scores over a 15-min period were 39.4, 37.1, and 23.1 for malic acid at pH 3, 5, and 7, respectively. In predictive testing using patients with atopic dermatitis, 18 of 34 patients reacted to a diet high in malic and citric acids, and 6 reacted to a diet high in malic acid. In assessing the effect of malic acid on cell renewal, an 18%, 10%, and 5% increase was observed at pH 3, 5, and 7, respectively. Malic acid was not toxic in a clinical efficacy and safety test.	10

**Table 2.** Constituent acids with CIR conclusions

Myristic Acid	safe as used (2010; 15% in leave-ons; 50% in rinse-offs)	Myristic acid is approved as a food reagent and additive. Myristic acid enhanced the dermal penetration of several drugs. The acute oral LD <sub>50</sub> and acute dermal LD <sub>50</sub> of salts of myristic acid were >8 g/kg and >16 mL/kg, respectively, in rats. Acute dermal application of butyl myristate (2 g/kg) was nontoxic and nonirritating to rabbits. When 10 rabbits were treated with a single dermal dose of ethyl myristate (5 g/kg) resulted in the death of 2 over 7 days. The intraperitoneal and subcutaneous LD <sub>50</sub> for isopropyl myristate exceeded 79.5 mL/kg in rats and the intraperitoneal LD <sub>50</sub> was >50.2 mL/kg in mice. No death occurred, and no evidence of systemic toxicity was found at necropsy when the rats were exposed to aerosolized isopropyl myristate. Myristic acid, isopropyl myristate, and myristyl myristate were minimally irritating to the eyes of rabbits. Butyl myristate was nonirritating to the rabbit eye. Myristic acid was nonirritating in a single insult occlusive patch test and slightly irritating in a repeat open patch test on rabbits. Butyl myristate was a moderate skin irritant in rabbits and guinea pigs. Isopropyl myristate and myristyl myristate were minimally irritating in several formulations in rabbits and mice. Isopropyl myristate was nonirritating when injected parenterally in albino rabbits. Butyl myristate and myristyl myristate were nonsensitizing to guinea pigs. Isopropyl myristate and myristyl myristate were comedogenic to rabbit ears. Isopropyl myristate tested negative in the Salmonella/microsome test, with and without activation. In clinical primary and cumulative irritation studies, myristic acid was nonirritating. Isopropyl myristate can produce slight irritation but is not a human sensitizer at up to 50%.	9
Oleic Acid	safe as used (1987; reaffirmed in 2006; 25% in leave-ons; 50% in rinse-offs)	See lauric acid.	7.8
Olive Acid	safe as used (2011; no reported use)	See coconut acid.	3
Palm Acid	Safe as used (2011; no concentration reported in leave-ons, 17% in rinse-offs)	See coconut acid.	3
Palmitic Acid	safe as used (1987; reaffirmed in 2006; 25% in leave-ons, 25% in rinse-offs)	See lauric acid.	7.8
Sunflower Seed Acid	safe as used (2011; no reported use)	See coconut acid.	3
Stearic Acid	safe as used (1987; reaffirmed in 2006; >50% in leave-ons; 50% in rinse-offs)	See lauric acid.	7.8



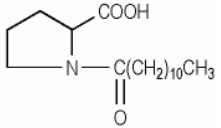
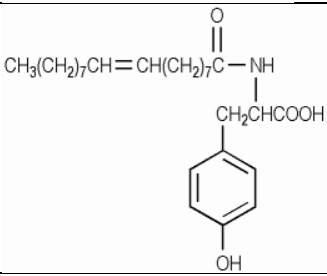
**Table 3.** Idealized structures of the ingredients in this safety assessment.<sup>17</sup> (The asterisk marked structures below represent additions made by CIR staff.)

Acetyl Arginine	
Acetyl Cysteine	
Acetyl Glutamic Acid	
Acetyl Glutamine	
Acetyl Histidine	
Acetyl Methionine	
Acetyl Proline	
Acetyl Tyrosine	
Capryloyl Collagen Amino Acids	* $\text{CH}_3(\text{CH}_2)_6\text{C}(=\text{O})\text{---NRR}'$ where NRR' represents the amino acid residues from collagen
Capryloyl Glycine	
Capryloyl Gold of Pleasure Amino Acids	* $\text{CH}_3(\text{CH}_2)_6\text{C}(=\text{O})\text{---NRR}'$ where NRR' represents the amino acid residues from gold of pleasure
Capryloyl Keratin Amino Acids	* $\text{CH}_3(\text{CH}_2)_6\text{C}(=\text{O})\text{---NRR}'$ where NRR' represents the amino acid residues from keratin
Capryloyl Pea Amino Acids	* $\text{CH}_3(\text{CH}_2)_6\text{C}(=\text{O})\text{---NRR}'$ where NRR' represents the amino acid residues from pea
Capryloyl Quinoa Amino Acids	* $\text{CH}_3(\text{CH}_2)_6\text{C}(=\text{O})\text{---NRR}'$ where NRR' represents the amino acid residues from quinoa
Capryloyl Silk Amino Acids	* $\text{CH}_3(\text{CH}_2)_6\text{C}(=\text{O})\text{---NRR}'$ where NRR' represents the amino acid residues from silk

**Table 3.** Idealized structures of the ingredients in this safety assessment.<sup>17</sup> (The asterisk marked structures below represent additions made by CIR staff.)

Cocoyl Glutamic Acid	$\begin{array}{c} \text{O} \\ \parallel \\ \text{RC}-\text{NHCHCOOH} \\   \\ \text{CH}_2\text{CH}_2\text{COOH} \end{array}$ <p>where RCO- represents the fatty acids derived from coconut oil.</p>
Dipalmitoyl Cystine	$\begin{array}{c} \text{HOOCCHCH}_2\text{S}-\text{SCH}_2\text{CHCOOH} \\   \qquad   \\ \text{CH}_3(\text{CH}_2)_{14}\text{C}=\text{O} \quad \text{NH} \quad \quad \quad \text{HN} \quad \quad \text{C}(\text{CH}_2)_{14}\text{CH}_3 \\ \parallel \qquad \qquad \qquad \qquad \qquad \parallel \\ \text{O} \qquad \qquad \qquad \qquad \qquad \qquad \text{O} \end{array}$
Dipotassium Capryloyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_8\text{C}-\text{NHCH}(\text{CH}_2)_2\text{COOK} \\   \\ \text{COOK} \end{array}$
Dipotassium Undecylenoyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_2=\text{CH}(\text{CH}_2)_8\text{C}-\text{NHCH}(\text{CH}_2)_2\text{COOK} \\   \\ \text{COOK} \end{array}$
Disodium Capryloyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_8\text{C}-\text{NHCH}(\text{CH}_2)_2\text{COONa} \\   \\ \text{COONa} \end{array}$
Disodium Cocoyl Glutamate	$\begin{array}{c} \text{NaOOC}(\text{CH}_2)_2\text{CHCOONa} \\   \\ \text{HN}-\text{CR} \\ \parallel \\ \text{O} \end{array}$ <p>where RCO- represents the fatty acids derived from coconut oil.</p>
Disodium Hydrogenated Tallow Glutamate	$\begin{array}{c} \text{NaOOC}(\text{CH}_2)_2\text{CHCOONa} \\   \\ \text{RC}-\text{NH} \\ \parallel \\ \text{O} \end{array}$ <p>where RCO- represents the fatty acids derived from hydrogenated tallow.</p>
Disodium N-Lauroyl Aspartate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{10}\text{C}-\text{NHCHCOONa} \\   \\ \text{CH}_2\text{COONa} \end{array}$
Disodium Lauroyl Glutamate	$\begin{array}{c} \text{NaOOC}(\text{CH}_2)_2\text{CHCOONa} \\   \\ \text{HN}-\text{C}(\text{CH}_2)_{10}\text{CH}_3 \\ \parallel \\ \text{O} \end{array}$
Disodium Malyl Tyrosinate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{NaOOCCH}_2\text{CHC}-\text{NHCHCOONa} \\   \qquad   \\ \text{OH} \qquad \text{CH}_2 \\ \qquad \qquad \text{C}_6\text{H}_4 \\ \qquad \qquad   \\ \qquad \qquad \text{OH} \end{array}$
Disodium Stearoyl Glutamate	$\begin{array}{c} \text{NaOOC}(\text{CH}_2)_2\text{CHCOONa} \\   \\ \text{HN}-\text{C}(\text{CH}_2)_{16}\text{CH}_3 \\ \parallel \\ \text{O} \end{array}$
Disodium Undecylenoyl Glutamate	$\begin{array}{c} \text{NaOOC}(\text{CH}_2)_2\text{CHCOONa} \\   \\ \text{HN}-\text{C}(\text{CH}_2)_8\text{CH}=\text{CH}_2 \\ \parallel \\ \text{O} \end{array}$

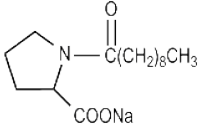
**Table 3.** Idealized structures of the ingredients in this safety assessment.<sup>17</sup> (The asterisk marked structures below represent additions made by CIR staff.)

Lauroyl Arginine	$\text{CH}_3(\text{CH}_2)_{10}\overset{\text{O}}{\parallel}\text{C}-\text{NHCH}(\text{CH}_2)_3\text{NHC}(\text{NH}_2)=\text{NH}$
Lauroyl Collagen Amino Acids	$* \text{CH}_3(\text{CH}_2)_{10}\overset{\text{O}}{\parallel}\text{C}-\text{NRR}'$ <p>where NRR' represents the amino acid residues from collagen</p>
Lauroyl Glutamic Acid	$\text{HOOCCH}_2\text{CH}_2\text{CHCOOH}$ $\quad \quad \quad  $ $\quad \quad \quad \text{HN}-\overset{\text{O}}{\parallel}\text{C}(\text{CH}_2)_{10}\text{CH}_3$
Lauroyl Lysine	$\text{NH}_2(\text{CH}_2)_4\text{CHCOOH}$ $\quad \quad \quad  $ $\quad \quad \quad \text{NH}-\overset{\text{O}}{\parallel}\text{C}(\text{CH}_2)_{10}\text{CH}_3$
Lauroyl Proline	
Lauroyl Silk Amino Acids	$* \text{CH}_3(\text{CH}_2)_{10}\overset{\text{O}}{\parallel}\text{C}-\text{NRR}'$ <p>where NRR' represents the amino acid residues from silk</p>
Magnesium Palmitoyl Glutamate	$\left[ \begin{array}{c} \text{OOCCH}_2\text{CH}_2\text{CHCOO}^- \\   \\ \text{HN}-\overset{\text{O}}{\parallel}\text{C}(\text{CH}_2)_{14}\text{CH}_3 \end{array} \right] \text{Mg}^{+2}$
Myristoyl Glutamic Acid	$\text{HO}-\overset{\text{O}}{\parallel}\text{CCH}_2\text{CH}_2\text{CH}-\text{OH}$ $\quad \quad \quad  $ $\quad \quad \quad \text{NH}-\overset{\text{O}}{\parallel}\text{C}(\text{CH}_2)_{12}\text{CH}_3$
Oleoyl Tyrosine	$\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\overset{\text{O}}{\parallel}\text{C}-\text{NH}$ $\quad \quad \quad  $ $\quad \quad \quad \text{CH}_2\text{CHCOOH}$ 
Palmitoyl Alanine	$\text{CH}_3(\text{CH}_2)_{14}\overset{\text{O}}{\parallel}\text{C}-\text{NHCH}(\text{CH}_3)\text{COOH}$
Palmitoyl Arginine	$\text{CH}_3(\text{CH}_2)_{14}\overset{\text{O}}{\parallel}\text{C}-\text{NHCH}(\text{CH}_2)_3\text{NHC}(\text{NH}_2)=\text{NH}$
Palmitoyl Collagen Amino Acids	$* \text{CH}_3(\text{CH}_2)_{14}\overset{\text{O}}{\parallel}\text{C}-\text{NRR}'$ <p>where NRR' represents the amino acid residues from collagen</p>

**Table 3.** Idealized structures of the ingredients in this safety assessment.<sup>17</sup> (The asterisk marked structures below represent additions made by CIR staff.)

Palmitoyl Glutamic Acid	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{14}\text{C}-\text{NHCH}(\text{CH}_2\text{CH}_2\text{COOH}) \\   \\ \text{COOH} \end{array}$
Palmitoyl Glycine	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{14}\text{C}-\text{NHCH}_2\text{COOH} \end{array}$
Palmitoyl Gold of Pleasure Amino Acids	$* \text{CH}_3(\text{CH}_2)_{14}\text{C}(=\text{O})-\text{NRR}'$ <p>where NRR' represents the amino acid residues from gold of pleasure</p>
Palmitoyl Isoleucine	$\begin{array}{c} \text{CH}_3 \quad \text{O} \\   \quad \parallel \\ \text{CH}_3\text{CH}_2\text{CHCHC}-\text{OH} \\   \\ \text{NH}-\text{C}(\text{CH}_2)_{14}\text{CH}_3 \\ \parallel \\ \text{O} \end{array}$
Palmitoyl Keratin Amino Acids	$* \text{CH}_3(\text{CH}_2)_{14}\text{C}(=\text{O})-\text{NRR}'$ <p>where NRR' represents the amino acid residues from keratin</p>
Palmitoyl Millet Amino Acids	$* \text{CH}_3(\text{CH}_2)_{14}\text{C}(=\text{O})-\text{NRR}'$ <p>where NRR' represents the amino acid residues from millet</p>
Palmitoyl Oat Amino Acids	$* \text{CH}_3(\text{CH}_2)_{14}\text{C}(=\text{O})-\text{NRR}'$ <p>where NRR' represents the amino acid residues from oat</p>
Palmitoyl Pea Amino Acids	$* \text{CH}_3(\text{CH}_2)_{14}\text{C}(=\text{O})-\text{NRR}'$ <p>where NRR' represents the amino acid residues from pea</p>
Palmitoyl Proline	$* \begin{array}{c} \text{O} \\ \parallel \\ (\text{CH}_2)_{14}-\text{C} \\   \\ \text{Me} \\ \text{N} \\ \diagup \quad \diagdown \\ \text{C} \quad \text{C} \\ \diagdown \quad \diagup \\ \text{S} \quad \text{CO}_2\text{H} \end{array}$
Palmitoyl Quinoa Amino Acids	$* \text{CH}_3(\text{CH}_2)_{14}\text{C}(=\text{O})-\text{NRR}'$ <p>where NRR' represents the amino acid residues from quinoa</p>
Palmitoyl Silk Amino Acids	$* \text{CH}_3(\text{CH}_2)_{14}\text{C}(=\text{O})-\text{NRR}'$ <p>where NRR' represents the amino acid residues from silk</p>
Potassium Capryloyl Tyrosine	$\begin{array}{c} \text{OH} \\   \\ \text{C}_6\text{H}_4 \\   \\ \text{CH}_2\text{CH}(\text{C}(=\text{O})\text{OK}) \\   \\ \text{NH}-\text{C}(\text{CH}_2)_8\text{CH}_3 \\ \parallel \\ \text{O} \end{array}$
Potassium Capryloyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_8\text{C}-\text{NHCH}(\text{CH}_2)_2\text{COOK} \\   \\ \text{COOH} \end{array}$

**Table 3.** Idealized structures of the ingredients in this safety assessment.<sup>17</sup> (The asterisk marked structures below represent additions made by CIR staff.)

Potassium Cocoyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{RC} - \text{NHCH}(\text{CH}_2)_2\text{COOH} \\   \\ \text{COOK} \end{array}$	where RCO- represents the fatty acids derived from coconut oil.
Potassium Cocoyl Glycinate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{RC} - \text{NHCH}_2\text{COOK} \end{array}$	where RCO- represents the cocoyl moiety.
Potassium Cocoyl Rice Amino Acids	$\begin{array}{c} \text{O} \\ \parallel \\ * \text{RC} - \text{NRCH}_2\text{COOK} \end{array}$	where RCO- represents the cocoyl moiety and NRCH <sub>2</sub> COOK represents the salt of the rice amino acid residues
Potassium Lauroyl Collagen Amino Acids	$\begin{array}{c} \text{O} \\ \parallel \\ * \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NRCH}_2\text{COOK} \end{array}$	where NRCH <sub>2</sub> COOK represents the salt of the collagen amino acid residues
Potassium Lauroyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NHCHCOOK} \\   \\ \text{CH}_2\text{CH}_2\text{COOH} \end{array}$	
Potassium Lauroyl Oat Amino Acids	$\begin{array}{c} \text{O} \\ \parallel \\ * \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NRCH}_2\text{COOK} \end{array}$	where NRCH <sub>2</sub> COOK represents the salt of the oat amino acid residues
Potassium Lauroyl Pea Amino Acids	$\begin{array}{c} \text{O} \\ \parallel \\ * \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NRCH}_2\text{COOK} \end{array}$	where NRCH <sub>2</sub> COOK represents the salt of the pea amino acid residues
Potassium Lauroyl Silk Amino Acids	$\begin{array}{c} \text{O} \\ \parallel \\ * \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NRCH}_2\text{COOK} \end{array}$	where NRCH <sub>2</sub> COOK represents the salt of the silk amino acid residues
Potassium Lauroyl Wheat Amino Acids	$\begin{array}{c} \text{O} \\ \parallel \\ * \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NRCH}_2\text{COOK} \end{array}$	where NRCH <sub>2</sub> COOK represents the salt of the wheat amino acid residues
Potassium Myristoyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{12}\text{C} - \text{NHCHCOOK} \\   \\ \text{CH}_2\text{CH}_2\text{COOH} \end{array}$	
Potassium Olivoyl/Lauroyl Wheat Amino Acids	$\begin{array}{c} \text{O} \\ \parallel \\ * \text{RC} - \text{NRCH}_2\text{COOK} \end{array}$	where RCO- represents the olivoyl/lauroyl moiety and NRCH <sub>2</sub> COOK represents the salt of the wheat amino acid residues
Potassium Stearoyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{16}\text{C} - \text{NHCHCOOK} \\   \\ \text{CH}_2\text{CH}_2\text{COOH} \end{array}$	
Potassium Undecylenoyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_2 = \text{CH}(\text{CH}_2)_8\text{C} - \text{NHCH}(\text{CH}_2)_2\text{COOK} \\   \\ \text{COOH} \end{array}$	
Propionyl Collagen Amino Acids	$\begin{array}{c} \text{O} \\ \parallel \\ * \text{CH}_3\text{CH}_2\text{C} - \text{NRR}' \end{array}$	where NRR' represents the amino acid residues from collagen
Sodium Caproyl Prolinate		

**Table 3.** Idealized structures of the ingredients in this safety assessment.<sup>17</sup> (The asterisk marked structures below represent additions made by CIR staff.)

Sodium Capryloyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_6\text{C}-\text{NHCH}(\text{CH}_2)_2\text{COONa} \\   \\ \text{COOH} \end{array}$
Sodium Cocoyl Alaninate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{RC}-\text{NHCHCOONa} \\   \\ \text{CH}_3 \end{array}$ <p>where RCO- represents the fatty acids derived from coconut oil.</p>
Sodium Cocoyl Amino Acids	$\begin{array}{c} \text{O} \\ \parallel \\ * \text{RC}-\text{NRCH}_2\text{COONa} \end{array}$ <p>where RCO- represents the cocoyl moiety and NRCH<sub>2</sub>COONa represents the salt of amino acid residues</p>
Sodium Cocoyl Apple Amino Acids	$\begin{array}{c} \text{O} \\ \parallel \\ * \text{RC}-\text{NRCH}_2\text{COONa} \end{array}$ <p>where RCO- represents the cocoyl moiety and NRCH<sub>2</sub>COONa represents the salt of apple amino acid residues</p>
Sodium Cocoyl Barley Amino Acids	$\begin{array}{c} \text{O} \\ \parallel \\ * \text{RC}-\text{NRCH}_2\text{COONa} \end{array}$ <p>where RCO- represents the cocoyl moiety and NRCH<sub>2</sub>COONa represents the salt of barley amino acid residues</p>
Sodium Cocoyl Collagen Amino Acids	$\begin{array}{c} \text{O} \\ \parallel \\ * \text{RC}-\text{NRCH}_2\text{COONa} \end{array}$ <p>where RCO- represents the cocoyl moiety and NRCH<sub>2</sub>COONa represents the salt of collagen amino acid residues</p>
Sodium Cocoyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{RC}-\text{NH} \\   \\ \text{HOOCCH}_2\text{CH}_2\text{CHCOONa} \end{array}$ <p>where RCO- represents the fatty acids derived from coconut oil.</p>
Sodium Cocoyl Glutamine	$\begin{array}{c} \text{O} \qquad \qquad \text{O} \\ \parallel \qquad \qquad \parallel \\ \text{RC}-\text{NHCH}(\text{CH}_2)_2\text{CH}_2\text{C}-\text{NH}_2 \\   \\ \text{COONa} \end{array}$ <p>where RCO- represents the fatty acids derived from coconut oil.</p>
Sodium Cocoyl Glycinate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{RC}-\text{NHCH}_2\text{COONa} \end{array}$ <p>where RCO- represents the cocoyl moiety.</p>
Sodium Cocoyl/Hydrogenated Tallow Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{HOOCCH}_2\text{CH}_2\text{CHCOONa} \\   \\ \text{HN}-\text{CR} \\ \parallel \\ \text{O} \end{array}$ <p>where RCO- represents a mixture of fatty acids derived from coconut oil and hydrogenated tallow.</p>
Sodium Cocoyl Oat Amino Acids	$\begin{array}{c} \text{O} \\ \parallel \\ * \text{RC}-\text{NRCH}_2\text{COONa} \end{array}$ <p>where RCO- represents the cocoyl moiety and NRCH<sub>2</sub>COONa represents the salt of oat amino acid residues</p>
Sodium Cocoyl/Palmoyl/Sunfloweroyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{RC}-\text{NH} \\   \\ \text{HOOCCH}_2\text{CH}_2\text{CHCOONa} \end{array}$ <p>where RCO- represents the mixture of fatty acids.</p>
Sodium Cocoyl Proline	$\begin{array}{c} \text{O} \\ \parallel \\ \text{N}-\text{CR} \\   \\ \text{COONa} \end{array}$ <p>where RCO- represents the fatty acids derived from coconut oil.</p>

**Table 3.** Idealized structures of the ingredients in this safety assessment.<sup>17</sup> (The asterisk marked structures below represent additions made by CIR staff.)

Sodium Cocoyl Threoninate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{RC} - \text{NHCHCOONa} \\   \\ \text{CH}_3\text{CHOH} \end{array}$	where RCO- represents the fatty acids derived from Cocos Nucifera (Coconut) Oil
Sodium Cocoyl Wheat Amino Acids	$* \begin{array}{c} \text{O} \\ \parallel \\ \text{RC} - \text{NRCH}_2\text{COONa} \end{array}$	where RCO- represents the cocoyl moiety and NRCH <sub>2</sub> COONa represents the salt of wheat amino acid residues
Sodium Hydrogenated Tallowoyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{RC} - \text{NHCH}(\text{CH}_2)_2\text{COOH} \\   \\ \text{COONa} \end{array}$	where RCO- represents the fatty acids derived from hydrogenated tallow.
Sodium Lauroyl Aspartate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NHCHCOOH} \\   \\ \text{CH}_2\text{COONa} \end{array}$	
Sodium Lauroyl Collagen Amino Acids	$* \begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NRCH}_2\text{COONa} \end{array}$	where NRCH <sub>2</sub> COONa represents the salt of the collagen amino acid residues
Sodium Lauroyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NHCHCOONa} \\   \\ \text{CH}_2\text{CH}_2\text{COOH} \end{array}$	
Sodium Lauroyl Millet Amino Acids	$* \begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NRCH}_2\text{COONa} \end{array}$	where NRCH <sub>2</sub> COONa represents the salt of the millet amino acid residues
Sodium Lauroyl/Myristoyl Aspartate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{RC} - \text{NHCHCOONa} \\   \\ \text{CH}_2\text{COOH} \end{array}$	where RCO- represents the lauroyl/myristoyl grouping.
Sodium Lauroyl Oat Amino Acids	$* \begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NRCH}_2\text{COONa} \end{array}$	where NRCH <sub>2</sub> COONa represents the salt of the oat amino acid residues
Sodium Lauroyl Silk Amino Acids	$* \begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NRCH}_2\text{COONa} \end{array}$	where NRCH <sub>2</sub> COONa represents the salt of the silk amino acid residues
Sodium Lauroyl Wheat Amino Acids	$* \begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NRCH}_2\text{COONa} \end{array}$	where NRCH <sub>2</sub> COONa represents the salt of the wheat amino acid residues
Sodium Myristoyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_3(\text{CH}_2)_{12}\text{C} - \text{NHCHCOONa} \\   \\ \text{CH}_2\text{CH}_2\text{COOH} \end{array}$	
Sodium Olivoyl Glutamate	$\begin{array}{c} \text{O} \\ \parallel \\ \text{RC} - \text{NH} \\   \\ \text{HOOCCH}_2\text{CH}_2\text{CHCOONa} \end{array}$	where RCO- represents the fatty acids derived from olive oil.
Sodium Palmitoyl Proline	$\begin{array}{c} \text{O} \\ \parallel \\ \text{N} - \text{C}(\text{CH}_2)_{14}\text{CH}_3 \\   \\ \text{COONa} \end{array}$	

**Table 3.** Idealized structures of the ingredients in this safety assessment.<sup>17</sup> (The asterisk marked structures below represent additions made by CIR staff.)

Sodium Palmoyl Glutamate	$\begin{array}{c} \text{O} \\    \\ \text{RC} - \text{NH} \\   \\ \text{HOOCCH}_2\text{CH}_2\text{CHCOONa} \end{array}$	where RCO- represents the palmoyl radical.
Sodium Stearoyl Glutamate	$\begin{array}{c} \text{O} \\    \\ \text{CH}_3(\text{CH}_2)_{16}\text{C} - \text{NHCHCOONa} \\   \\ \text{CH}_2\text{CH}_2\text{COOH} \end{array}$	
Sodium/TEA-Lauroyl Collagen Amino Acids	$\begin{array}{c} \text{O} \\    \\ * \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NRCH}_2\text{COOM} \end{array}$	where NRCH <sub>2</sub> COOM represents the mixture of sodium and TEA salts of the collagen amino acid residues
Sodium/TEA-Lauroyl Keratin Amino Acids	$\begin{array}{c} \text{O} \\    \\ * \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NRCH}_2\text{COOM} \end{array}$	where NRCH <sub>2</sub> COOM represents the mixture of sodium and TEA salts of the keratin amino acid residues
Sodium/TEA-Undecylenoyl Collagen Amino Acids	$\begin{array}{c} \text{O} \\    \\ * \text{CH}_3(\text{CH}_2)_{10}\text{C} - \text{NRCH}_2\text{COOM} \end{array}$	where NRCH <sub>2</sub> COOM represents the mixture of sodium and TEA salts of the keratin amino acid residues
Sodium Undecylenoyl Glutamate	$\begin{array}{c} \text{O} \\    \\ \text{CH}_2 = \text{CH}(\text{CH}_2)_8\text{C} - \text{NHCH}(\text{CH}_2)_2\text{COONa} \\   \\ \text{COOH} \end{array}$	
Stearoyl Glutamic Acid	$\begin{array}{c} \text{O} \\    \\ \text{HOOCCH}_2\text{CH}_2\text{CHCOOH} \\   \\ \text{HN} - \text{C}(\text{CH}_2)_{16}\text{CH}_3 \\    \\ \text{O} \end{array}$	
Stearoyl Leucine	$\begin{array}{c} \text{O} \\    \\ \text{CH}_3(\text{CH}_2)_{17}\text{C} - \text{NHCHCOOH} \\   \\ \text{CH}_2\text{CHCH}_3 \\   \\ \text{CH}_3 \end{array}$	
TEA-Cocoyl Alaninate	$\begin{array}{c} \text{O} \\    \\ \text{RC} - \text{NHCHCOOH} \\   \\ \text{CH}_3 \end{array} \cdot \text{N}(\text{CH}_2\text{CH}_2\text{OH})_3$	where RCO- represents the fatty acids derived from coconut oil.
TEA-Cocoyl Glutamate	$\begin{array}{c} \text{O} \\    \\ \text{RC} - \text{NHCHCOOH} \\   \\ \text{CH}_2\text{CH}_2\text{COOH} \end{array} \cdot \text{N}(\text{CH}_2\text{CH}_2\text{OH})_3$	where RCO- represents the fatty acids derived from coconut oil.
TEA-Cocoyl Glutamate	$\begin{array}{c} \text{O} \qquad \qquad \qquad \text{O} \\    \qquad \qquad \qquad    \\ \text{RC} - \text{NHCHCH}_2\text{CH}_2\text{C} - \text{NH}_2 \\   \\ \text{COOH} \end{array} \cdot \text{N}(\text{CH}_2\text{CH}_2\text{OH})_3$	where RCO- represents the coconut acid moiety.
TEA-Hydrogenated Tallowyl Glutamate	$\begin{array}{c} \text{O} \\    \\ \text{HOOCCH}_2\text{CH}_2\text{CHNH} - \text{CR} \\   \\ \text{COOH} \end{array} \cdot \text{N}(\text{CH}_2\text{CH}_2\text{OH})_3$	where RCO- represents the fatty acids derived from hydrogenated tallow.



**Table 3.** Idealized structures of the ingredients in this safety assessment.<sup>17</sup> (The asterisk marked structures below represent additions made by CIR staff.)

TEA-Lauroyl Collagen Amino Acids	$* \text{CH}_3(\text{CH}_2)_{10}\overset{\text{O}}{\parallel}\text{C}-\text{NRCH}_2\text{COOH} \cdot \text{N}(\text{CH}_2\text{CH}_2\text{OH})_3$ <p>where NRCH<sub>2</sub>COOH N(CH<sub>2</sub>CH<sub>2</sub>OH)<sub>3</sub> represents the TEA salt of the collagen amino acid residues</p>
TEA-Lauroyl Glutamate	$\text{CH}_3(\text{CH}_2)_{10}\overset{\text{O}}{\parallel}\text{C}-\text{NHCHCOOH} \cdot \text{N}(\text{CH}_2\text{CH}_2\text{OH})_3$ <p style="text-align: center;">  CH<sub>2</sub>CH<sub>2</sub>COOH</p>
TEA-Lauroyl Keratin Amino Acids	$* \text{CH}_3(\text{CH}_2)_{10}\overset{\text{O}}{\parallel}\text{C}-\text{NRCH}_2\text{COOH} \cdot \text{N}(\text{CH}_2\text{CH}_2\text{OH})_3$ <p>where NRCH<sub>2</sub>COOH N(CH<sub>2</sub>CH<sub>2</sub>OH)<sub>3</sub> represents the TEA salt of the keratin amino acid residues</p>
TEA-Lauroyl/Myristoyl Aspartate	$\text{RC}-\overset{\text{O}}{\parallel}\text{NHCHCH}_2\text{COOH} \cdot \text{N}(\text{CH}_2\text{CH}_2\text{OH})_3$ <p style="text-align: center;">  COOH</p> <p style="text-align: right;">where RCO- represents the lauroyl/myristoyl grouping.</p>
Undecylenoyl Collagen Amino Acids	$* \text{CH}_3(\text{CH}_2)_9\overset{\text{O}}{\parallel}\text{C}-\text{NRR}'$ <p>where NRR' represents the amino acid residues from collagen</p>
Undecylenoyl Glycine	$\text{CH}_2=\text{CH}(\text{CH}_2)_8\overset{\text{O}}{\parallel}\text{C}-\text{NHCH}_2\text{COOH}$
Undecylenoyl Phenylalanine	
Undecylenoyl Wheat Amino Acids	$* \text{CH}_3(\text{CH}_2)_9\overset{\text{O}}{\parallel}\text{C}-\text{NRR}'$ <p>where NRR' represents the amino acid residues from wheat</p>
Zinc Lauroyl Aspartate	$\left[ \text{CH}_3(\text{CH}_2)_{10}\overset{\text{O}}{\parallel}\text{C}-\text{NHCHCOO}^- \right] \text{Zn}^{+2}$ <p style="text-align: center;">  CH<sub>2</sub>COO<sup>-</sup></p>

**Table 4.** Chemical properties of amino acids alkyl amides

<b>Property</b>	<b>Value</b>	<b>Reference</b>
<i>Acetyl Arginine</i>		
Molecular Weight g/mol	216.24	PubChem
<i>Acetyl Cysteine</i>		
Physical Form	Crystals in water	Merck
Odor	Slight acetic	Merck
Molecular Weight g/mol	163.19	<sup>23</sup>
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	126.0	<sup>23</sup>
Density/Specific Gravity @ 20 °C	1.294	<sup>23</sup>
Vapor pressure mmHg@ 25 °C	8.68 x 10 <sup>-8</sup>	<sup>23</sup>
Melting Point °C	109-110	Merck
Boiling Point °C	407.7	<sup>23</sup>
Solubility	Freely sol in water, alcohol. Practically insol in chloroform, ether	Merck
logP @ 25 °C	-0.696	<sup>23</sup>
Disassociation constants (pKa, pKb) @ 25 °C	3.25 most acidic; -0.91 most basic	<sup>23</sup>
<i>Acetyl Glutamic Acid</i>		
Molecular Weight g/mol	189.17	<sup>23</sup>
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	139.6	<sup>23</sup>
Density/Specific Gravity @ 20 °C	1.354	<sup>23</sup>
Vapor pressure mmHg@ 25 °C	3.48 x 10 <sup>-11</sup>	<sup>23</sup>
Boiling Point °C	495.9	<sup>23</sup>
logP @ 25 °C	-2.131	<sup>23</sup>
Disassociation constants (pKa) @ 25°C	3.45 most acidic; -0.86 most basic	<sup>23</sup>
<i>Acetyl Glutamine</i>		
Physical Form	Crystals from ethanol	Merck
Molecular Weight g/mol	188.18	<sup>23</sup>
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	145.8	<sup>23</sup>
Density/Specific Gravity @ 20 °C	1.290	<sup>23</sup>
Vapor pressure mmHg@ °C	1.28 x 10 <sup>-8</sup>	<sup>23</sup>
Melting Point °C	197	Merck
Boiling Point °C	430.5	<sup>23</sup>
logP @ 25 °C	-2.215	<sup>23</sup>
Disassociation constants (pKa) @ 25°C	2.19 most acidic; 9.19 most basic	<sup>23</sup>

**Table 4.** Chemical properties of amino acids alkyl amides

<i>Acetyl Methionine</i>		
Physical Form	Crystals; large prisms from water (DL-); plates from water or ethyl acetate (D-)	Merck
Molecular Weight g/mol	191.25	<sup>23</sup>
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	158.9	<sup>23</sup>
Density/Specific Gravity @ 20 °C	1.202	<sup>23</sup>
Vapor pressure mmHg@ °C	1.72 x 10 <sup>-9</sup>	<sup>23</sup>
Melting Point °C	102-104; 114-115 (DL-); 104-105 (D-)	Merck
Boiling Point °C	453.6	<sup>23</sup>
Water Solubility g/100 ml @ 25 °C	9.12 (DL-); 30.7 (D-)	Merck
Other Solubility g/100 ml @ 25 °C	Acetone 10.0 (DL-) and 29.6 (D-); Ethyl acetate 2.29 (DL-) and 7.04 (D-); chloroform 1.33 (DL-) and 6.43 (D-)	Merck
logP @ 25 °C	-0.885	<sup>23</sup>
Disassociation constants (pKa) @ 25°C	3.50 most acidic; -0.84 most basic	<sup>23</sup>
<i>Acetyl Tyrosine</i>		
Molecular Weight g/mol	223.23	<sup>23</sup>
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	171.1	<sup>23</sup>
Density/Specific Gravity @ 20 °C	1.304	<sup>23</sup>
Vapor pressure mmHg@ °C	4.07 x 10 <sup>-12</sup>	<sup>23</sup>
Boiling Point °C	531.3	<sup>23</sup>
logP @ 25 °C	-1.676	<sup>23</sup>
Disassociation constants (pKa) @ 25°C	3.15 most acidic; -0.83 most basic	<sup>23</sup>
<i>Capryloyl Glycine</i>		
Molecular Weight g/mol	201.26	<sup>23</sup>
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	194.1	<sup>23</sup>
Density/Specific Gravity @ 20 °C	1.036	<sup>23</sup>
Vapor pressure mmHg@ °C	1.19 x 10 <sup>-7</sup>	<sup>23</sup>
Boiling Point °C	403.9	<sup>23</sup>
logP @ 25 °C	1.065	<sup>23</sup>
Disassociation constants (pKa) @ 25°C	3.62 most acidic; -0.98 most basic	<sup>23</sup>
<i>Dipalmitoyl Cystine</i>		
Molecular Weight g/mol	717.12	<sup>23</sup>
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	685.6	<sup>23</sup>
Density/Specific Gravity @ 20 °C	1.045	<sup>23</sup>
Vapor pressure mmHg@ 25 °C	3.93 x 10 <sup>-32</sup>	<sup>23</sup>
Boiling Point °C	852.2	<sup>23</sup>
logP @ 25 °C	12.988	<sup>23</sup>
Disassociation constants (pKa) @ 25°C	2.93 most acidic; -0.63 most basic	<sup>23</sup>

**Table 4.** Chemical properties of amino acids alkyl amides

<i>Disodium Capryloyl Glutamate</i>		
Physical Form @ 20 °C	Clear to light turbid liquid	24
Color	Colorless to light yellow	24
pH @ 20°C	9.0-10.5	24
<i>Lauroyl Arginine</i>		
Molecular Weight g/mol	356.50	23
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	316.2	23
Density/Specific Gravity @ 20 °C	1.12	23
logP @ 25 °C	2.547	23
Disassociation constants (pKa) @ 25°C	3.60 most acidic; 13.84 most basic	23
<i>Lauroyl Glutamic Acid</i>		
Molecular Weight g/mol	329.43	23
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	304.7	23
Density/Specific Gravity @ 20 °C	1.081	23
Vapor pressure mmHg@ °C	2.95 x 10 <sup>-13</sup>	23
Melting Point °C	95-96	11
Boiling Point °C	543.6	23
logP @ 25 °C	2.964	23
Disassociation constants (pKa) @ 25°C	3.46 most acidic; -0.88 most basic	23
<i>Lauroyl Proline</i>		
Molecular Weight g/mol	297.43	23
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	288.3	23
Density/Specific Gravity @ 20 °C	1.031	23
Vapor pressure mmHg@ °C	6.01 x 10 <sup>-10</sup>	23
Boiling Point °C	465.3	23
logP @ 25 °C	5.356	23
Disassociation constants (pKa) @ 25°C	3.70 most acidic; -2.37 most basic	23
<i>Palmitoyl Alanine</i>		
Molecular Weight g/mol	327.50	23
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	343.1	23
Density/Specific Gravity @ 20 °C	0.954	23
Vapor pressure mmHg@ °C	2.73 x 10 <sup>-11</sup>	23
Boiling Point °C	498.4	23
logP @ 25 °C	5.495	23
Disassociation constants (pKa) @ 25°C	3.69 most acidic; -0.81 most basic	23

**Table 4.** Chemical properties of amino acids alkyl amides

<b><i>Palmitoyl Arginine</i></b>		
Molecular Weight g/mol	412.61	23
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	380.5	23
Density/Specific Gravity @ 20 °C	1.08	23
logP @ 25 °C	4.585	23
Disassociation constants (pKa) @ 25 °C	3.60 most acidic; 13.84 most basic	23
<b><i>Palmitoyl Glutamic Acid</i></b>		
Molecular Weight g/mol	385.54	23
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	370.7	23
Density/Specific Gravity @ 20 °C	1.039	23
Vapor pressure mmHg@ °C	5.17 x 10 <sup>-15</sup>	23
Boiling Point °C	581.1	23
logP @ 25 °C	5.002	23
Disassociation constants (pKa) @ 25 °C	3.46 most acidic; -0.88 most basic	23
<b><i>Palmitoyl Glycine</i></b>		
Molecular Weight g/mol	313.48	23
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	326.2	23
Density/Specific Gravity @ 20 °C	0.960	23
Vapor pressure mmHg@ °C	5.13 x 10 <sup>-11</sup>	23
Melting Point °C	122-125	11
Boiling Point °C	491.8	23
logP @ 25 °C	5.141	23
Disassociation constants (pKa) @ 25 °C	3.59 most acidic; -1.01 most basic	23
<b><i>Palmitoyl Isoleucine</i></b>		
Molecular Weight g/mol	369.58	23
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	392.9	23
Density/Specific Gravity @ 20 °C	0.940	23
Vapor pressure mmHg@ °C	1.44 x 10 <sup>-12</sup>	23
Boiling Point °C	528.2	23
logP @ 25 °C	6.867	23
Disassociation constants (pKa) @ 25 °C	3.67 most acidic; -0.81 most basic	23
<b><i>Palmitoyl Proline</i></b>		
Molecular Weight g/mol	353.54	23
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	354.3	23
Density/Specific Gravity @ 20 °C	0.997	23
Vapor pressure mmHg@ °C	7.58 x 10 <sup>-12</sup>	23

**Table 4.** Chemical properties of amino acids alkyl amides

Boiling Point °C	511.6	23
logP @ 25 °C	7.394	23
Disassociation constants (pKa) @ 25°C	3.69 most acidic; -2.37 most basic	23
<hr/>		
<i>Sodium Lauroyl Glutamate</i>		
Physical Form @ 20 °C	Clear to slightly turbid liquid	20
Color	Colorless to slightly yellow	20
<hr/>		
<i>Stearoyl Glutamic Acid</i>		
Molecular Weight g/mol	413.594	25
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	403.7	23
Density/Specific Gravity @ 20 °C	1.024	23
Vapor pressure mmHg@ °C	5.85 x 10 <sup>-16</sup>	23
Melting Point °C	154.75	25
Boiling Point °C	600.3	23
logP @ 25 °C	6.021	23
Disassociation constants (pKa) @ 25°C	3.46 most acidic; -0.88 most basic	23
<hr/>		
<i>Stearoyl Leucine</i>		
Molecular Weight g/mol	397.63	23
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	426.0	23
Density/Specific Gravity @ 20 °C	0.933	23
Vapor pressure mmHg@ °C	1.41 x 10 <sup>-13</sup>	23
Melting Point °C	64-65	13
Boiling Point °C	550.6	23
logP @ 25 °C	7.886	23
Disassociation constants (pKa) @ 25°C	3.67 most acidic; -0.81 most basic	23
<hr/>		
<i>Undecylenoyl Phenylalanine</i>		
Molecular Weight g/mol	331.45	23
Molecular Volume cm <sup>3</sup> /mol @ 20 °C	316.3	23
Density/Specific Gravity @ 20 °C	1.047	23
Vapor pressure mmHg@ °C	1.70x 10 <sup>-12</sup>	23
Boiling Point °C	540.0	23
logP @ 25 °C	3.155	23
Disassociation constants (pKa) @ 25°C	3.63 most acidic; -0.82 most basic	23

**Table 5a.** Frequency and concentration of use (2012-2013) according to duration and type of exposure for Amino Acid Alkyl Amides.<sup>26</sup>

	<i># of Uses</i>	<i>Max Conc of Use (%)</i>	<i># of Uses</i>	<i>Max Conc of Use (%)</i>	<i># of Uses</i>	<i>Max Conc of Use (%)</i>
	<b>Acetyl Cysteine</b>		<b>Acetyl Glutamine</b>		<b>Acetyl Methionine</b>	
<b>Totals*</b>	<b>21</b>	<b>0.0005-0.1</b>	<b>8</b>	<b>0.01-1</b>	<b>7</b>	<b>0.00001</b>
<b>Duration of Use</b>						
Leave-On	12	0.0005-0.1	2	0.01-1	5	0.00001
Rinse-Off	9	NR	6	0.1	2	NR
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	2	NR	NR	NR	2	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	1 <sup>a</sup>	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	11	0.0005-0.03	2	0.01-1	2	NR
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	10	0.1	6	NR	4	0.00001
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	1	NR
Mucous Membrane	NR	NR	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Acetyl Tyrosine</b>		<b>Capryloyl Glycine</b>		<b>Cocoyl Glutamic Acid</b>	
<b>Totals*</b>	<b>27</b>	<b>0.03-0.3</b>	<b>75</b>	<b>0.05-2</b>	<b>NR</b>	<b>24</b>
<b>Duration of Use</b>						
Leave-On	21	0.08-0.3	46	0.09-2	NR	NR
Rinse Off	6	0.03	28	0.05-2	NR	24
Diluted for (Bath) Use	NR	NR	1	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	2	0.3	3	0.4-2	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	3	NR	4	0.1	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	19	0.03-0.3	62	0.05-2	NR	24
Deodorant (underarm)	NR	NR	2	0.1	NR	NR
Hair - Non-Coloring	8	0.3	10	0.4-2	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	1	NR	6	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Disodium Capryloyl Glutamate</b>		<b>Disodium Cocoyl Glutamate</b>		<b>Disodium Hydrogenated Tallow Glutamate</b>	
<b>Totals*</b>	<b>2</b>	<b>0.4</b>	<b>43</b>	<b>0.02-3</b>	<b>NR</b>	<b>0.1-1</b>
<b>Duration of Use</b>						
Leave-On	2	NR	8	0.02-0.3	NR	0.1
Rinse-Off	NR	0.4	35	0.6-3	NR	1
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	1	0.02-0.05	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	0.3 <sup>b</sup>	NR	NR
Incidental Inhalation-Powder	NR	NR	2	0.1	NR	NR
Dermal Contact	2	0.4	28	0.02-3	NR	0.1-1
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	15	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	0.05	NR	NR
Mucous Membrane	NR	NR	7	0.6-2 <sup>c</sup>	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR

**Table 5a.** Frequency and concentration of use (2012-2013) according to duration and type of exposure for Amino Acid Alkyl Amides.<sup>26</sup>

	<i># of Uses</i>	<i>Max Conc of Use (%)</i>	<i># of Uses</i>	<i>Max Conc of Use (%)</i>	<i># of Uses</i>	<i>Max Conc of Use (%)</i>
	<b>Disodium Lauroyl Glutamate</b>		<b>Disodium Malyl Tyrosinate</b>		<b>Disodium Stearoyl Glutamate</b>	
<b>Totals</b>	<b>1</b>	<b>NR</b>	<b>1</b>	<b>NR</b>	<b>122</b>	<b>0.000006-6</b>
<b>Duration of Use</b>						
Leave-On	NR	NR	NR	NR	122	0.000006-6
Rinse Off	1	NR	NR	NR	NR	0.1-0.3
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	13	0.05-1
Incidental Ingestion	NR	NR	NR	NR	3	0.000006-0.02
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	3	0.2-6
Dermal Contact	1	NR	1	NR	118	0.03-6
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	NR	3	0.000006-0.02
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Lauroyl Arginine</b>		<b>Lauroyl Collagen Amino Acids</b>		<b>Lauroyl Lysine</b>	
<b>Totals*</b>	<b>1</b>	<b>NR</b>	<b>1</b>	<b>NR</b>	<b>604</b>	<b>0.001-45</b>
<b>Duration of Use</b>						
Leave-On	NR	NR	NR	NR	598	0.001-45
Rinse-Off	1	NR	1	NR	6	0.001-0.3
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	240	0.005-10.2
Incidental Ingestion	NR	NR	NR	NR	23	0.2-45
Incidental Inhalation-Spray	NR	NR	NR	NR	7	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	158	0.005-12
Dermal Contact	NR	NR	NR	NR	539	0.005-14
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	1	NR	1	NR	4	0.001-0.3
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	1	0.001
Mucous Membrane	NR	NR	NR	NR	23	0.2-45
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Lauroyl Proline</b>		<b>Lauroyl Silk Amino Acids</b>		<b>Magnesium Palmitoyl Glutamate</b>	
<b>Totals*</b>	<b>1</b>	<b>NR</b>	<b>2</b>	<b>NR</b>	<b>14</b>	<b>0.0006-0.2</b>
<b>Duration of Use</b>						
Leave-On	1	NR	1	NR	14	0.0006-0.2
Rinse-Off	NR	NR	1	NR	NR	NR
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	0.2 <sup>d</sup>
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	1	NR	1	NR	13	0.0006-0.2
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	1	NR	NR	0.2
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	1	0.001-0.002
Mucous Membrane	NR	NR	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR



**Table 5a.** Frequency and concentration of use (2012-2013) according to duration and type of exposure for Amino Acid Alkyl Amides.<sup>26</sup>

	<i># of Uses</i>	<i>Max Conc of Use (%)</i>	<i># of Uses</i>	<i>Max Conc of Use (%)</i>	<i># of Uses</i>	<i>Max Conc of Use (%)</i>
	<b>Oleoyl Tyrosine</b>		<b>Palmitoyl Collagen Amino Acids</b>		<b>Palmitoyl Glycine</b>	
<b>Totals*</b>	<b>3</b>	<b>NR</b>	<b>1</b>	<b>NR</b>	<b>5</b>	<b>1</b>
<b>Duration of Use</b>						
Leave-On	3	NR	1	NR	5	1
Rinse-Off	NR	NR	NR	NR	NR	NR
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	3	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	3	NR	1	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	3	NR	1	NR	5	1
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	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Palmitoyl Keratin Amino Acids</b>		<b>Palmitoyl Proline</b>		<b>Palmitoyl Silk Amino Acids</b>	
<b>Totals*</b>	<b>5</b>	<b>NR</b>	<b>14</b>	<b>NR</b>	<b>2</b>	<b>NR</b>
<b>Duration of Use</b>						
Leave-On	4	NR	14	NR	2	NR
Rinse-Off	1	NR	NR	NR	NR	NR
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	4	NR	13	NR	2	NR
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	1	NR	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	1	NR	NR	NR
Mucous Membrane	NR	NR	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Potassium Cocoyl Glutamate</b>		<b>Potassium Cocoyl Glycinate</b>		<b>Potassium Lauroyl Wheat Amino Acids</b>	
<b>Totals*</b>	<b>6</b>	<b>0.03-12</b>	<b>13</b>	<b>1-39</b>	<b>4</b>	<b>0.7</b>
<b>Duration of Use</b>						
Leave-On	NR	0.03	NR	2	NR	NR
Rinse Off	6	3-12	13	1-39	4	0.7
Diluted for (Bath) Use	NR	6	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	6	0.03-12	13	1-39	4	0.7
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	8	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	3-6	3	1	1	NR
Baby Products	NR	NR	NR	NR	NR	NR

**Table 5a.** Frequency and concentration of use (2012-2013) according to duration and type of exposure for Amino Acid Alkyl Amides.<sup>26</sup>

	<i># of Uses</i>	<i>Max Conc of Use (%)</i>	<i># of Uses</i>	<i>Max Conc of Use (%)</i>	<i># of Uses</i>	<i>Max Conc of Use (%)</i>
	<b>Potassium Myristoyl Glutamate</b>		<b>Sodium Cocoyl Alaninate</b>		<b>Sodium Cocoyl Amino Acids</b>	
<b>Totals*</b>	<b>5</b>	<b>11-27</b>	<b>8</b>	<b>NR</b>	<b>21</b>	<b>0.4-2.8</b>
<b>Duration of Use</b>						
Leave-On	NR	NR	4	NR	10	0.4-1
Rinse-Off	5	11-27	4	NR	11	0.4-2.8
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	2	NR	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	0.4 <sup>e</sup>
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	5	11-27	6	NR	8	2.8
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	2	NR	12	0.4-1
Hair-Coloring	NR	NR	NR	NR	1	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	NR	NR	1	2.8
Baby Products	NR	NR	2	NR	NR	NR
	<b>Sodium Cocoyl Apple Amino Acids</b>		<b>Sodium Cocoyl Collagen Amino Acids</b>		<b>Sodium Cocoyl Glutamate</b>	
<b>Totals*</b>	<b>18</b>	<b>0.3-3</b>	<b>13</b>	<b>0.02</b>	<b>132</b>	<b>0.004-10</b>
<b>Duration of Use</b>						
Leave-On	7	0.3	3	0.02	60	0.004-3
Rinse-Off	11	0.5-3	10	0.02	70	0.01-10
Diluted for (Bath) Use	NR	NR	NR	NR	2	NR
<b>Exposure Type</b>						
Eye Area	5	0.3	1	NR	5	0.004-0.6
Incidental Ingestion	NR	NR	NR	NR	5	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	0.03% <sup>f</sup>
Incidental Inhalation-Powder	NR	NR	NR	NR	1	NR
Dermal Contact	16	0.3-3	2	NR	102	0.004-9
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	2	0.5	11	0.02	25	0.2-10
Hair-Coloring	NR	NR	NR	NR	NR	3
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	4	NR	1	NR	27	0.2-3
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Sodium Cocoyl Glycinate</b>		<b>Sodium Hydrogenated Tallowoyl Glutamate</b>		<b>Sodium Lauroyl Aspartate</b>	
<b>Totals*</b>	<b>22</b>	<b>0.2-20</b>	<b>2</b>	<b>0.8</b>	<b>2</b>	<b>0.005-2</b>
<b>Duration of Use</b>						
Leave-On	1	NR	1	0.8	2	0.005-0.2
Rinse Off	21	0.2-20	1	NR	NR	2
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	2	0.1
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	0.2
Dermal Contact	22	0.2-20	2	0.8	2	0.005-2
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	NR	2
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	0.2-3	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR

**Table 5a.** Frequency and concentration of use (2012-2013) according to duration and type of exposure for Amino Acid Alkyl Amides.<sup>26</sup>

	<i># of Uses</i>	<i>Max Conc of Use (%)</i>	<i># of Uses</i>	<i>Max Conc of Use (%)</i>	<i># of Uses</i>	<i>Max Conc of Use (%)</i>
	<b>Sodium Lauroyl Glutamate</b>		<b>Sodium Lauroyl Oat Amino Acids</b>		<b>Sodium Lauroyl Wheat Amino Acids</b>	
<b>Totals*</b>	<b>72</b>	<b>0.003-40</b>	<b>93</b>	<b>0.04-5</b>	<b>1</b>	<b>NR</b>
<b><i>Duration of Use</i></b>						
Leave-On	6	0.03-4	14	0.4-0.8	NR	NR
Rinse-Off	61	0.003-40	74	0.04-5	1	NR
Diluted for (Bath) Use	5	4	5	0.9	NR	NR
<b><i>Exposure Type</i></b>						
Eye Area	1	NR	NR	5	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	1	NR	NR	NR	NR	NR
Dermal Contact	51	0.003-40	66	0.09-5	1	NR
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	21	3	27	0.04-0.4	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	19	4	33	0.09-5	NR	NR
Baby Products	2	NR	1	NR	NR	NR
<b><i>Duration of Use</i></b>						
	<b>Sodium Myristoyl Glutamate</b>		<b>Sodium Palmitoyl Proline</b>		<b>Sodium Palmoyl Glutamate</b>	
<b>Totals*</b>	<b>48</b>	<b>0.1-31</b>	<b>3</b>	<b>NR</b>	<b>NR</b>	<b>2-22</b>
<b><i>Duration of Use</i></b>						
Leave-On	43	0.1-5	3	NR	NR	NR
Rinse-Off	5	0.1-31	NR	NR	NR	2-22
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b><i>Exposure Type</i></b>						
Eye Area	9	0.1	NR	NR	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	1	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	47	0.1-31	3	NR	NR	2-22
Deodorant (underarm)	NR	NR	1	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	1	0.5	NR	NR	NR	NR
Mucous Membrane	NR	31	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR
<b><i>Duration of Use</i></b>						
	<b>Sodium Stearoyl Glutamate</b>		<b>TEA-Cocoyl Alaninate</b>		<b>TEA-Cocoyl Glutamate</b>	
<b>Totals*</b>	<b>109</b>	<b>0.03-2</b>	<b>2</b>	<b>0.8</b>	<b>70</b>	<b>2-10.5</b>
<b><i>Duration of Use</i></b>						
Leave-On	96	0.2-2	NR	NR	9	2
Rinse Off	13	0.03-1.1	2	0.8	61	2-10.5
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b><i>Exposure Type</i></b>						
Eye Area	5	1	NR	NR	NR	NR
Incidental Ingestion	NR	1	NR	NR	NR	NR
Incidental Inhalation-Spray	4	0.2-0.3 <sup>e</sup>	NR	NR	1	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	103	0.2-2	2	0.8	69	2.1-10.5
Deodorant (underarm)	1	NR	NR	NR	NR	NR
Hair - Non-Coloring	6	0.03-0.2	NR	NR	1	2-10
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	2	1	NR	NR	43	2.1-3
Baby Products	NR	NR	NR	NR	1	NR

**Table 5a.** Frequency and concentration of use (2012-2013) according to duration and type of exposure for Amino Acid Alkyl Amides.<sup>26</sup>

	<i># of Uses</i>	<i>Max Conc of Use (%)</i>	<i># of Uses</i>	<i>Max Conc of Use (%)</i>	<i># of Uses</i>	<i>Max Conc of Use (%)</i>
	<b>TEA-Lauroyl Collagen AminoAcids</b>		<b>TEA-Lauroyl Glutamate</b>		<b>Undecylenoyl Collagen Amino Acids</b>	
<b>Totals*</b>	<b>3</b>	<b>0.4</b>	<b>1</b>	<b>NR</b>	<b>2</b>	<b>NR</b>
<b><i>Duration of Use</i></b>						
Leave-On	3	0.4	NR	NR	NR	NR
Rinse-Off	NR	NR	1	NR	2	NR
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b><i>Exposure Type</i></b>						
Eye Area	NR	NR	NR	NR	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	NR	NR	1	NR	NR	NR
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	3	0.4	NR	NR	2	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	1	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR
<b><i>Undecylenoyl Glycine</i></b>						
<b>Totals*</b>	<b>10</b>	<b>0.3</b>	<b>16</b>	<b>0.5-2</b>		
<b><i>Duration of Use</i></b>						
Leave-On	6	0.3	15	0.5-2		
Rinse-Off	4	NR	1	NR		
Diluted for (Bath) Use	NR	NR	NR	NR		
<b><i>Exposure Type</i></b>						
Eye Area	1	0.3	NR	NR		
Incidental Ingestion	NR	NR	NR	NR		
Incidental Inhalation-Spray	3	NR	NR	NR		
Incidental Inhalation-Powder	NR	NR	NR	NR		
Dermal Contact	4	0.3	16	0.5-2		
Deodorant (underarm)	NR	NR	NR	NR		
Hair - Non-Coloring	4	NR	NR	NR		
Hair-Coloring	NR	NR	NR	NR		
Nail	2	NR	NR	NR		
Mucous Membrane	NR	NR	NR	NR		
Baby Products	NR	NR	NR	NR		

<sup>a</sup>1% in a face and neck spray.<sup>b</sup>0.3% in a foundation spray.<sup>c</sup>0.6% in hand soap categorized as “other personal cleanliness product”.<sup>d</sup>0.2% in a pump hair spray; 0.2% in a spray tonic, dressing, and other hair grooming aids; and 0.2% in a body and hand spray.<sup>e</sup>0.4% in pump hair spray.<sup>f</sup>0.03% in a foundation spray.<sup>g</sup>0.2% in an indoor tanning product, 0.3% in a body and hand spray

**Table 5b.** Amino acid alkyl amides not reported in use.

Acetyl arginine	Potassium olivoyl/lauroyl wheat amino acids
Acetyl glutamic acid	Potassium stearyl glutamate
Acetyl histidine	Potassium undecylenoyl glutamate
Acetyl proline	Propionyl collagen amino acids
Capryloyl collagen amino acids	Sodium capryloyl proline
Capryloyl gold of pleasure amino acids	Sodium capryloyl glutamate
Capryloyl keratin amino acids	Sodium cocoyl barley amino acids
Capryloyl pea amino acids	Sodium cocoyl glutamate
Capryloyl quinoa amino acids	Sodium cocoyl/hydrogenated tallow glutamate
Capryloyl silk amino acids	Sodium cocoyl oat amino acids
Dipalmitoyl cysteine	Sodium cocoyl/palmitoyl/sunfloweroyl glutamate
Dipotassium capryloyl glutamate	Sodium cocoyl proline
Dipotassium undecylenoyl glutamate	Sodium cocoyl threoninate
Disodium N-lauroyl aspartate	Sodium cocoyl wheat amino acids
Disodium undecylenoyl glutamate	Sodium lauroyl collagen amino acids
Lauroyl glutamic acid	Sodium lauroyl millet amino acids
Myristoyl glutamic acid	Sodium lauroyl/myristoyl aspartate
Palmitoyl alanine	Sodium lauroyl silk amino acids
Palmitoyl arginine	Sodium lauroyl/myristoyl aspartate
Palmitoyl glutamic acid	Sodium lauroyl silk amino acids
Palmitoyl gold of pleasure amino acids	Sodium olivoyl glutamate
Palmitoyl isoleucine	Sodium/TEA-lauroyl collagen amino acids
Palmitoyl millet amino acids	Sodium/TEA-lauroyl keratin amino acids
Palmitoyl oat amino acids	Sodium/TEA-undecylenoyl collagen amino acids
Palmitoyl pea amino acids	Sodium undecylenoyl glutamate
Palmitoyl quinoa amino acids	Stearoyl glutamic acid
Potassium caproyl tyrosine	Stearoyl leucine
Potassium capryloyl glutamate	TEA cocoyl glutamate
Potassium cocoyl rice amino acids	TEA-hydrogenated tallowyl glutamate
Potassium lauroyl collagen amino acids	TEA-lauroyl keratin amino acids
Potassium lauroyl glutamate	TEA-lauroyl/myristoyl aspartate
Potassium lauroyl oat amino acids	Undecylenoyl wheat amino acids
Potassium lauroyl pea amino acids	Zinc lauroyl aspartate
Potassium lauroyl silk amino acids	

**Table 6.** Genotoxicity

Concentration/Dose	Method	Results	Reference
<i>In Vitro</i>			
<b>ACETYL GLUTAMIC ACID</b>			
333 to 5000 µg/plate with and without S9 metabolic activation	Bacterial reverse mutation assay in <i>Salmonella typhimurium</i> strains TA 98, TA 100, TA 1535, TA 1537 and <i>Escherichia coli</i> strain WP2uvrA	Not mutagenic	27
<b>ACETYL PROLINE</b>			
0.4%, 0.2%, 0.1%, 0.05%, 0.025%, and 0.0125% with S9 metabolic activation	Ames II assay in <i>S.typhimurium</i> strains TA 98 and mixed strains	Not mutagenic	28
<b>ACETYL TYROSINAMIDE</b>			
0, 313, 625, 1250, 2500, and 5000 µg/plate with and without S9 metabolic activation	Bacterial reverse mutation assay in <i>S. typhimurium</i> strains TA 98, TA 100, TA 1535, TA 1537 and <i>E.coli</i> strain WP2uvrA	Negative	29
Up to 2230 µg/mL under 3 h and 22 h treatment with and without metabolic activation	Chromosomal aberration assay in cultured peripheral blood lymphocytes	Negative	30
<b>DISODIUM CAPRYLOYL GLUTAMATE</b>			
Details not provided	Ames test (details not provided)	Not mutagenic	24
<b>SODIUM COCOYL GLUTAMATE</b>			
Details not provided	Ames test (details not provided)	Not mutagenic	16
<b>SODIUM LAUROYL GLUTAMATE</b>			
Details not provided	Ames test (details not provided)	Not mutagenic	31
<i>In Vivo</i>			
<b>ACETYL GLUTAMIC ACID</b>			
500, 1000, or 2000 mg/kg	Bone marrow micronucleus assay in groups of 5 male and 5 female ICR mice.	No increased incidence of micronucleated polychromatic erythrocytes	27

**Table 7.** Dermal irritation studies.

<b>Ingredient</b>	<b>Concentration</b>	<b>Method</b>	<b>Results</b>	<b>Reference</b>
<b><i>Non-Human</i></b>				
Acetyl Proline	8% in a cream tested neat	MatTek EpiDerm assay	Very mild irritant	<sup>32</sup>
Disodium Capryloyl Glutamate	5% of a solution containing 37%-41% test material	MTT Viability assay	Not irritating	<sup>24</sup>
<b><i>Human</i></b>				
Acetyl Proline	10% in a cream evaluated for treatment of eczema or active atopic dermatitis	Double-blind, randomized controlled usage study in 15 subjects where test material was applied to target lesion twice/day for 14 days	1 subject had an acute chronic dermatitis reaction that was considered related to the test material	<sup>33</sup>
Acetyl Tyroinamide	2% in a gel formulation	48-h patch test in 53 volunteers; semi-occluded	Not irritating	<sup>34</sup>
Acetyl Tyrosinamide	1.25%-2% in several gel and skin plumping cream formulations	48-h patch test in 51 volunteers; semi-occluded	1 subject had moderate erythema and edema post-application that became mild at the 72-h observation to the skin plumping cream containing 1.25% test material, another subject had mild erythema and edema 48-h to the same skin plumping cream formulation, which was barely perceptible at 72-h – this same subject had a barely perceptible erythema at 48-h to the skin plumping cream containing 2% of the test material, no reaction was observed at 72-h. The study concluded that the test material was not irritating in all formulations tested.	<sup>35</sup>
Disodium Capryloyl Glutamate	18% of a solution containing 37%-41% test material	Patch test with Finn Chambers in 20 volunteers; occluded	Not irritating	<sup>24</sup>
Sodium Cocoyl Glutamate	10% active matter	Flex Wash Test	Not irritating	<sup>16</sup>
Sodium Lauroyl Glutamate	10% active matter	Flex Wash Test in 20 volunteers	Irritation index below 0.5, not irritating	<sup>31</sup>
Sodium Lauroyl Glutamate	A 1% solution and in mixtures with SLS at 0.75%, 0.50% and 0.25%	15 volunteers received test material on test sites with polypropylene chambers for 24 h. Application sites were measured for transepidermal water loss (TEWL) and graded for irritation reactions.	TEWL values of 1% SLG were significantly higher than those of the deionized water control.	<sup>36</sup>

**Table 8.** Ocular irritation studies.

<b>Ingredient</b>	<b>Concentration</b>	<b>Method</b>	<b>Results</b>	<b>Reference</b>
<b>Non-Human</b>				
Acetyl Tyrosinamide	1.25% neat	EpiOcular irritation study	Not irritating	<sup>37</sup>
Disodium Capryloyl Glutamate	2% as received	HET-CAM method	Not irritating	<sup>24</sup>
Lauroyl Arginine + mixture of collagen polypeptides with MW < 1000 Da	10%, pH adjusted to 7.0	Draize method in 6 male albino rabbits	Mean score was 7.5, not irritating	<sup>38</sup>
Sodium Cocoyl Glutamate	Not reported	Red Blood Cell test	Not irritating	<sup>16</sup>
Sodium Cocoyl Glutamate	5%	HET-CAM method	Score = 13, strong or severe irritation	<sup>39,40</sup>
Sodium Lauroyl Glutamate	5% active matter	HET-CAM method	Not irritating	<sup>31</sup>
Sodium Lauroyl Glutamate	Not reported	Red Blood Cell test	Not irritating	<sup>15</sup>
Sodium Lauroyl Glutamate	Up to 1%	Rabbit corneal epithelium model by measurement of viability with MTT assay	Viability at concentration 0.5% was 32.7%. The 50% inhibitory concentration (IC50) was 0.934%.	<sup>41</sup>
<b>Human</b>				
Acetyl Hydroxyproline	2% in a gel under eye treatment	4 week in-use study in 33 women; half contact lens wearers and half non-contact lens wearers	No adverse events during the study and no ophthalmic irritation potential	<sup>42</sup>
Acetyl Tyrosinamide	2% in a gel under eye treatment	4 week in-use study in 33 women; half contact lens wearers and half non-contact lens wearers	No adverse events during the study and no ophthalmic irritation potential	<sup>43</sup>

**Table 9.** Dermal sensitization studies.

<b>Ingredient</b>	<b>Concentration</b>	<b>Method</b>	<b>Results</b>	<b>Reference</b>
<b>Human</b>				
Acetyl Hydroxyproline	2% in a plumper gel	HRIPT in 109 volunteers; semi-occluded	Not irritating or sensitizing	<sup>44</sup>
Acetyl Proline	10% in a cream	HRIPT in 107 volunteers; semi-occluded	Not irritating or sensitizing	<sup>45</sup>
Acetyl Tyrosinamide	1% neat	HRIPT to a sodium lauryl sulfate pre-treated site with 26 volunteers; occluded	Non-sensitizing	<sup>46</sup>
Acetyl Tyrosinamide	2% in a plumper gel	HRIPT in 109 volunteers; semi-occluded	Not irritating or sensitizing	<sup>47</sup>
Disodium Capryloyl Glutamate	18% of a solution containing 37%-41% test material	Patch test with Finn Chambers in 20 volunteers; occluded	Non- sensitizing	<sup>24</sup>
Sodium Cocoyl Glutamate	5% active matter	Method not reported, but test was occluded	Non-sensitizing	<sup>16</sup>
Sodium Lauroyl Glutamate	5% active matter	Patch test with Finn Chambers in 20 volunteers; occluded	Non-sensitizing	<sup>31</sup>

**Table 10.** Phototoxicity and photosensitization

<b>Ingredient</b>	<b>Concentration</b>	<b>Method</b>	<b>Results</b>	<b>Reference</b>
<b>Non-Human</b>				
Acetyl Tyrosinamide	Eight doses up to 1000 µg/mL with and without UVA	Neutral red uptake assay in BALB/c 3T3 mouse fibroblasts	Not predicted to have phototoxic potential	<sup>48</sup>
<b>Human</b>				
Acetyl Tyrosinamide	1% neat	Human photocontact allergenicity assay with 25 volunteers; occluded	No photocontact-sensitizing potential	<sup>49</sup>
Sodium Cocoyl Glutamate	0.1%-5% aq. solutions	Not reported	No abnormality observed	<sup>16</sup>
Sodium Lauroyl Glutamate	0.1%-5% aq. solutions	Not reported	No abnormality observed	<sup>15</sup>



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