

---

## Safety Assessment of Polyglyceryl Fatty Acid Esters as Used in Cosmetics

---

Status: Tentative Report for Public Comment  
Release Date: June 10, 2016  
Panel Meeting Date: September 26-27, 2016

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date to comment on this safety assessment and to identify additional published data that should be included or provide unpublished data which can be made public and included.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 All unpublished data submitted to CIR will be discussed in open meetings, will be available at the CIR office for review by any interested party and may be cited in a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

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

## **ABSTRACT**

*The Cosmetic Ingredient Review (CIR) Expert Panel (Panel) assessed the safety of 274 polyglyceryl fatty acid esters. Each of the esters in this group is a polyether comprising 2 to 20 glyceryl residues, end-capped by esterification with simple carboxylic acids, such as fatty acids. Most of these ingredients are reported to function in cosmetics as skin-conditioning agents and/or surfactants. The Panel reviewed the available data and considered conclusions from relevant previous CIR reports, and determined that these ingredients are safe in cosmetics in the present practices of use and concentration described in this safety assessment when formulated to be non-irritating.*

## **INTRODUCTION**

This is a safety assessment of the polyglyceryl fatty acid esters as used in cosmetic formulations. Each of the esters in this group is a polyether comprising 2 to 20 glyceryl residues, end-capped by esterification with simple carboxylic acids, such as fatty acids. The 274 ingredients included in this report are listed alphabetically in Table 1. Table 2 and Table 3 present these ingredients based initially by increasing polyglyceryl chain length and second by increasing alkyl chain length; however, when there is a mixture of fatty acid constituents, those ingredients are presented by chain length for the polyglyceryl moiety and alphabetically based on the fatty acid component. Test data are presented based on increasing chain length (i.e., the order provided in Table 2 and Table 3).

According to the *International Cosmetic Ingredient Dictionary and Handbook*, most of these ingredients are reported to function in cosmetics as skin-conditioning agents and/or surfactants<sup>1</sup> (Table 3). Additional functions have also been reported.

In 2011, the Cosmetic Ingredient Review (CIR) Expert Panel (Panel) published a safety assessment of a family of ingredients that included Polyglyceryl-20 Octaisiononanoate; the Panel concluded that all of the ingredients named in that report are safe in the present practices of use and concentration identified in that assessment.<sup>2</sup> Because Polyglyceryl-20 Octaisiononanoate is a polyglyceryl fatty acid ester and is structurally related to the ingredients in this report, it is being included in this safety assessment.

The Panel has recently reviewed the safety of monoglyceryl monoesters, and concluded that the monoglyceryl monoesters are safe in cosmetics in the present practices of use and concentration described in that safety assessment.<sup>3</sup> Monoglyceryl monoesters and the polyglyceryl fatty acid esters both consist of the same starting materials, and they have the same potential metabolites. The difference between these two families of ingredients is that monoglyceryl monoesters are structurally constituted of the esterification products of only one equivalent of glycerin and one equivalent of a carboxylic acid, as opposed to the varying number of equivalents of glycerin and fatty acids in the polyglyceryl esters.

The Panel has previously reviewed the safety of ingredients that represent some of the starting materials of the polyglyceryl fatty acid esters that may persist as residual impurities in the polyglyceryl esters products, or may represent potential metabolites (e.g., from the action of esterases in the skin), such as glycerin and free fatty acids. A list of relevant ingredients that have been reviewed and the associated conclusions are provided in Table 4. (The full reports can be found on the CIR website: <http://www.cir-safety.org/ingredients>). Other ingredients, such as dipropylene glycol and polypropylene glycols (PPGs), have also been reviewed and are also included in Table 4 because they have similar properties and functions.

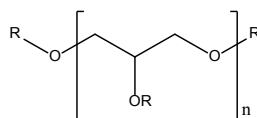
Much of the toxicity data included in this safety assessment were found on the European Chemicals Agency (ECHA) website.<sup>4</sup> The ECHA website provides summaries of information generated by industry, and it is the summary data that are reported in this safety assessment when ECHA is cited. Also, when deemed appropriate, read-across data from ECHA are included in this report. In some ECHA dossiers, such as in 1,2,3-propanetriol, homopolymer, diisooctadecanoate, the number of polyglyceryl chains is not defined. Because the number of polyglyceryl chains is not defined, and it therefore is unclear what specific ingredient is being studied, the data are presented as potential read-across data.

Several studies that are summarized in this safety assessment examined the toxicity of a “polyglyceryl ester”. The exact composition of the test material was not identified in many of the studies and, generally, very few details were provided. However, this information is included in this safety assessment for completeness.

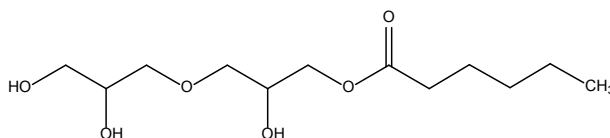
## **CHEMISTRY**

### **Definition and Structure**

The ingredients in this report are each structurally constituted of the esterification products of polyglycerin chains and fatty acids. These ingredients vary in the number of equivalents of glycerin and fatty acids, and the length of those fatty acids (Figures 1 and 2). The definitions and idealized structures of the polyglyceryl fatty acid esters are provided in Table 3.



**Figure 1.** Generic structure of polyglyceryl esters, wherein R represents hydrogen or the residue of certain fatty acids, and n varies from 2 to 20



**Figure 2.** Polyglyceryl-2 caprate (wherein R, in the general structure in Figure 1, is hydrogen in 3 instances and caprate in 1 instance; and n is 2)

The polymerization process used to produce polyglycerol yields a distribution of different oligomers that have a primarily linear structure.<sup>5</sup> In addition to the linear configuration, a significant part of the polyglycerol is of the branched types, e.g., originating from 1,2- and 2,2-*O*-ether linkages.

Polyglyceryl esters of fatty acids have a hydrophilic polyglycerol group that consists of a finite number of hydroxyethers of glycerol and a hydrophobic fatty acid chain within the same compound.<sup>6</sup> These ingredients are non-ionic compounds, and a range of polarities is possible because of the variation of the degree of polymerization and number of fatty acids per head-group.

### Physical and Chemical Properties

The physical properties and appearance of polyglyceryl esters of fatty acids mainly depends on their molecular structure. Typically, the physical form of those with a higher degree of polymerization and shorter or unsaturated fatty acid chains ranges from viscous liquids to plastic pastes, and the polyglyceryl esters with a lower degree of polymerization and longer, saturated fatty acid chains are generally powders, flakes or small beads.<sup>6</sup> The color of the esters is dependent on the source of the fatty acids, but the polyglycerol will contribute to the color.<sup>5</sup> The solubility of polyglyceryl esters in organic solvents depends on the nature of the solvent and the polarity of the ester but, generally, the esters will show best solubility in protic and polar aprotic solvents, such as lower alcohols and dimethyl sulfoxide (DMSO).

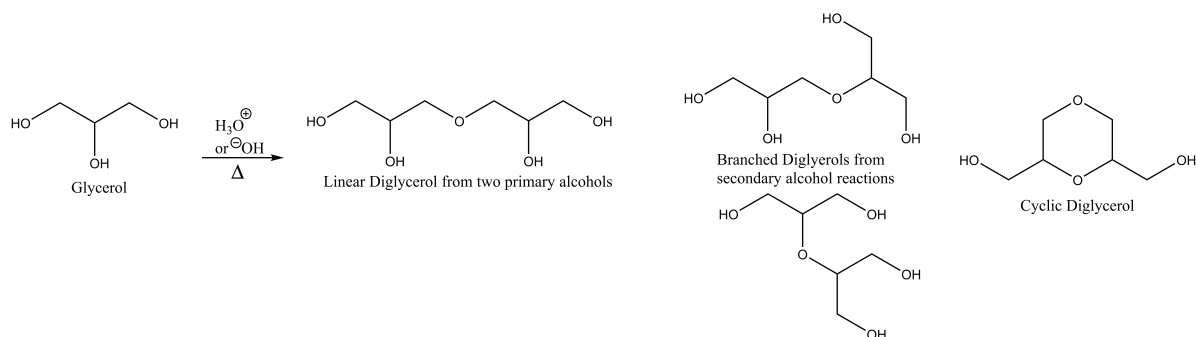
Polyglyceryl esters of fatty acids are polar or amphiphilic lipids, and the amphiphilic properties in water exhibit mesomorphic activities forming lyotropic liquid crystals.<sup>6</sup> The polyglyceryl ester as a polar emulsifier will form aggregated bodies, such as micelles, at low concentrations in water. Polyglyceryl esters of fatty acids become unstable with water and high temperatures, and the instability is enhanced in the presence of alkaline substances. The presence of an alkali or acid results in the partial hydrolysis of fatty acids and the formation of free polyglycerol.

Polyglyceryl esters are comparable to monoglycerides with respect to hydrolysis. In enzymatic systems, lipases will hydrolyze the polyglyceryl ester, as seen in the case of other glycerides.<sup>5</sup>

The average fatty acid compositions (when available) are described in Table 5, and the physical and chemical properties of many of the ingredients included in this safety assessment are presented in Table 6.

### Method of Manufacture

The synthesis of polyglyceryl esters of fatty acids is achieved by the polymerization of a hydrophilic headgroup, and then esterification of the headgroup with the hydrophobic tails.<sup>6</sup> Polyglycerols are generally prepared from an alkaline condensation of glycerol molecules at elevated temperature, with the removal of water. Because one glycerol molecule possesses 3 reactive sites (1 secondary alcohol (center position) and 2 primary alcohols (terminal positions)), several kinds of diglycerol molecules can be formed. If the polymerization proceeds to tri-, tetra-, or higher glycerols, then the number of possible linear or branched isomers increases exponentially. Moreover, once a dimer is formed, cyclic products can result from intramolecular ring-closure reactions (Figure 3).



**Figure 3.** Polymerization of glycerol<sup>7</sup>

Polyglycerols can be used as produced, or they may be stripped of excess glycerol and cyclic glycerols by steam distillation at reduced pressure.<sup>7</sup> Alternatively, stripping processes have been developed using mesoporous and zeolite catalysts under milder conditions.

Other possible processes for production of a polyglycerol use reactive petrochemical substances such as epichlorohydrine (1-chloro-2,3-dihydroxypropane), which is allowed to react with glycerol in an etherification process. However, epichlorohydrine is a hazardous material, and the purification of the polyglycerol complicates the process.<sup>5</sup> Glycidol is also used for the production of polyglycerol, and the oxirane group easily reacts with glycerol or epichlorohydrine, depending on the conditions of the reaction and the type of polyglycerol required. However, these processes use chemicals that make the process non-competitive in relation to a glycerol based process.

According to the World Health Organization (WHO) Food and Agriculture Organization (FAO), polyglyceryl esters of fatty acids (as used in foods) are formed by reacting polymerized glycerols with edible fats, oils (edible fats and oils are primarily triglycerides), or fatty acids.<sup>8</sup> The degree of polymerization varies, and is specified by a number (such as tri-) that is related to the average number of glycerol residues per polyglycerol molecule.

Polyglyceryl esters of fatty acids also can be prepared by direct esterification between polyolethers and fatty acids at elevated temperatures ( $T > 200^\circ\text{C}$ ) with the removal of water.<sup>5,6</sup> The esterification is normally carried out under alkaline conditions and can be stopped by simply adding an acid and lowering the reaction temperature. To obtain a large amount of mono- and diesters, the synthesis is generally carried out with an excess of polyglycerol. Some unreacted polyglycerol can be removed by simple gravimetric settling, and the remaining fraction by extraction with water combined with salts in a charge-wise separation process. Alternatively, polyglyceryl esters can be prepared by an inter-esterification (or transesterification) between polyglycerols and triglycerides; this is a reaction carried out at a high temperature and under conditions similar to direct esterification, but the degree of polymerization is not as high as obtained with direct esterification. Transesterification between polyglycerol and alcohol esters of fatty acids is another possible method of synthesis; using this process, methanol is continuously removed from the reactor, and the process includes a second step to reduce the remaining unreacted oxirane oxygen.

### Composition and Impurities

Joint FAO/WHO Expert Committee on Food Additives (JECFA) specifications for polyglyceryl esters of fatty acids used in foods state “the polyglycerol moiety shall be composed of not less than 70% of di-, tri- and tetraglycerols and shall contain not more than 10% of polyglycerols equal to or higher than heptaglycerol”; that acids other than fatty acids shall not be detectable; and that not more than 2 mg/kg lead is detectable.<sup>8</sup> Minor amounts of mono-, di-, and triglycerides, free glycerol and polyglycerols, free fatty acids, and sodium salts of fatty acids may be present.

Trace amounts of unreacted glycerol and fatty acid soaps can be found in polyglyceryl esters of fatty acids.<sup>6</sup> Specifications, impurities or constituents of some of the ingredients included in this report are provided in Table 7.

### USE Cosmetic

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

Based on 2015 VCRP data and the results of the Council surveys, 74 of the 274 ingredients included in this report are reported to be in use. According to 2015 VCRP registration data, Polyglyceryl-3 Diisostearate has the most reported uses of the

ingredients included in this report; of the 356 reported uses, 350 are in leave-on formulations, 260 of which are in lipsticks<sup>9</sup> (Table 8). Polyglyceryl-4 Isostearate has the second highest number of reported use; of the 269 uses, all but one are in leave-on products. The results of the concentration of use surveys conducted by the Council indicate Polyglyceryl-2 Triisostearate and Polyglyceryl-3 Diisostearate have the highest concentration of use in a leave-on formulation; these ingredients are used at 40% and 39%, respectively<sup>10-14</sup> (Table 8). Additionally, supplier-recommended use concentrations are provided; most of the recommended use levels are  $\leq 10\%$  (Table 9).

Use concentrations were reported for several ingredients that were not reported as used in the VCRP; it should be presumed there is at least one use in every category for which a concentration is reported. Additionally, several ingredients have uses reported in the VCRP, but concentration of use data were not received. The 200 ingredients with no reported uses in both the VCRP and industry survey are listed in Table 10.

Many of these polyglyceryl fatty acid esters are used in products applied to the eye area, products that can result in incidental ingestion, or products that come into contact with mucous membranes. The highest reported concentrations of use for these types of exposures are 24.1% Polyglyceryl-4 Isostearate in "other" eye make-up preparations and 40% Polyglyceryl-2 Triisostearate in lipstick formulations (resulting in incidental ingestion and mucous membrane exposure).<sup>11</sup> A few of the polyglyceryl fatty acid esters are reported to be used in baby products; Polyglyceryl-3 Diisostearate has the highest reported use in a baby product, i.e., 2% in baby lotions, oils, and creams.

Additionally, some of the polyglyceryl fatty acid esters are used in cosmetic sprays and could possibly be inhaled; for example, Polyglyceryl-3 Distearate is reported to be used at 3% spray body and hand creams. In practice, 95% to 99% of the droplets/particles released from cosmetic sprays have aerodynamic equivalent diameters  $>10\ \mu\text{m}$ , with propellant sprays yielding a greater fraction of droplets/particles  $<10\ \mu\text{m}$  compared with pump sprays.<sup>15,16</sup> Therefore, most droplets/particles incidentally inhaled from cosmetic sprays would be deposited in the nasopharyngeal and thoracic regions of the respiratory tract and would not be respirable (i.e., they would not enter the lungs) to any appreciable amount.<sup>17,18</sup>

All of the polyglyceryl fatty acids named in this report are listed in the European Union inventory of cosmetic ingredients, and none of the listed ingredients are restricted from use in any way under the rules governing cosmetic products in the European Union.<sup>19</sup> In Australia, according to a National Industrial Chemicals Notification and Assessment Scheme (NICNAS), Polyglyceryl-10 Laurate (~60% pure, with ~40% polyglycerin-10 and ~2% sodium laurate) is not considered to pose an unreasonable risk to public health when used in the proposed manner (i.e.,  $\leq 3\%$  in skin lotions), and cannot be classified according to the *Globally Harmonised System for the Classification and Labelling of Chemicals* or the *Approved Criteria for Classifying Hazardous Substances*.<sup>20</sup>

### **Non-Cosmetic**

Polyglyceryl esters of fatty acids, up to and including the decaglycerol esters, are permitted as multipurpose direct food additives when (1) they are prepared from corn oil, cottonseed oil, lard, palm oil from fruit, peanut oil, safflower oil, sesame oil, soybean oil, and tallow and the fatty acids derived from these substances (hydrogenated and non-hydrogenated) and/or oleic acid derived from tall oil fatty acids; (2) they are used as emulsifiers in food, in amounts not greater than that required to produce the intended physical or technical effect; (3) polyglyceryl esters of a mixture of stearic, oleic, and coconut fatty acids are used as a cloud inhibitor in vegetable and salad oils when use is not precluded by standards of identity, and oleic acid derived from tall oil fatty acids may be used as a substitute for, or together with, the oleic acid; and (4) polyglyceryl esters of butter oil fatty acids are used as emulsifiers in combination with other approved emulsifiers in dry, whipped topping base, when used at a level not in excess of the amount required to perform their emulsifying effect. [21CFR172.854]

JECFA established an acceptable daily intake (ADI) of 0-25 mg/kg bw for polyglyceryl esters of fatty acids having an average chain length of up to 3 glycerol units,<sup>21</sup> and an ADI of 0-7.5 mg/kg bw for polyglyceryl esters of interesterified ricinoleic acid.<sup>22</sup> In the EU, the esters are listed as food additives at concentrations between 5000 and 10,000 mg/kg in certain foods, and up to 7% free glycerol/polyglycerol is allowed (i.e., 700 mg/kg).<sup>23</sup> Polyglyceryl-10 Caprylate/Caprates<sup>24</sup> and Polyglyceryl-10 Oleate<sup>25</sup> are polysorbate replacers, dispersing agents, and emulsifiers in foods.

Polyglyceryl-3 Dioleate is used in human pharmaceutical products and in veterinary products.<sup>26</sup> It is reported to be suitable for hard and soft gelatin capsules, adsorption onto neutral carrier powders for use in tablets, capsule filling and sachets, and use in topical ointments, microemulsions and emulsions.

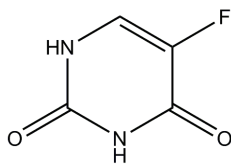
Polyglyceryl-10 Oleate is used as an internal lubricant for polyvinyl chloride (PVC) sheet and film and as an anti-fog agent in plasticized PVC film formulations.<sup>25</sup>

## **TOXICOKINETICS**

### **Penetration Enhancement**

#### **Polyglyceryl-3 Diisostearate**

Polyglyceryl-3 Diisostearate was not a penetration enhancer in a study that evaluated the skin penetration enhancing effects of several excipients on the hydrophilic drug 5-fluorouracil.<sup>34</sup>



**Figure 4.** 5-Fluorouracil

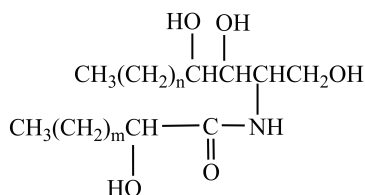
The ability to enhance skin penetration was determined *in vitro* by measuring skin permeability coefficients for human abdominal skin samples.

#### Polyglyceryl-3 Dioleate

Polyglyceryl-3 Dioleate is reported to be a water-in-oil surfactant/solubilizer associated with enhanced drug penetration.<sup>26</sup>

#### Polyglyceryl-4 Laurate and Polyglyceryl-4 Oleate

The effect of 2 microemulsions on the rate and extent of release and penetration of ceramide AP was evaluated using an *in vitro*, multi-layer, membrane model with 4 layers of circular 40-mm membrane films arranged one over the other.<sup>35</sup>



wherein m has a value ranging from 13 to 27 and n has a value ranging from 12 to 20.

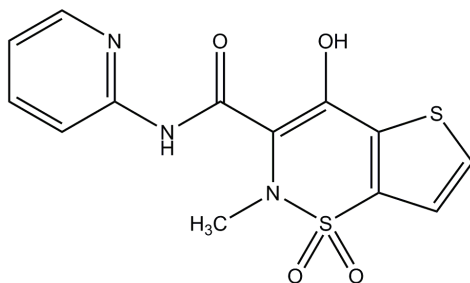
**Figure 5.** Ceramide AP

One test microemulsion, an o/w emulsion, contained 15% Polyglyceryl-4 Laurate, 15% Polyglyceryl-4 Oleate, and 60% water-1,2 pentanediol (1:9); the other, a w/o emulsion, contained 30% Polyglyceryl-4 Laurate, 15% isopropyl palmitate/linoleic acid (5:2), and 55% water-1,2 pentanediol (1.5-8.5). Both test formulations contained 0.4% ceramide AP. A non-ionic hydrophilic cream containing 0.5% ceramide AP was used as a reference formulation. Each test substance, in an amount that contained 50 µg ceramide AP, was spread evenly over a 4 cm<sup>2</sup> area. The formulation was left in place for 15-180 min; the unabsorbed test material was then removed and the ceramide was extracted from the membranes. When compared to the reference cream, the microemulsions increased the rate and extent of penetration of ceramide AP. Within 15 min, a higher percentage of ceramide AP was released from the microemulsions and penetrated into the deeper membrane layers; ceramide AP was not detected in the 3<sup>rd</sup> and 4<sup>th</sup> layers when the reference cream was used. Also, the amount that penetrated into each layer at each time point was greater with the microemulsions than with the cream. The total percent ceramide AP released and penetrated was 93.4% with the microemulsion containing 15% Polyglyceryl-4 Laurate and 15% Polyglyceryl-4 Oleate, 84.2% for the second test formulation, and 73.3% with the reference formulation.

The effect of similar microemulsions and microemulsion gels on the permeation of ceramide NP was evaluated in human thigh skin samples using Franz diffusion cells.<sup>36</sup> Several microemulsions were evaluated; the formulations were composed of 30 or 35% Polyglyceryl-4 Laurate/Polyglyceryl-4 Oleate (1:1), 10-15% isopropyl palmitate/linoleic acid (9:12), 50-60% water/1,2 pentanediol (1.5:8.5), 0.2% ceramide AP, and 0.1% deuterated ceramide NP. The gels were prepared by dispersing 2.5% Carbopol® 940 into the microemulsion. Some of the formulations were o/w, and some were bicontinuous. A hydrophilic cream containing 0.2% deuterated ceramide NP was used as a reference formulation. Twenty mg of each formulation was applied to the skin surface (3.1416 cm<sup>2</sup>) and allowed to permeate for 300 min. After 300 min, the skin surface was wiped and the stratum corneum layer was removed with 10 tape strips over a 2.016 cm<sup>2</sup> area. Subsequently, 3 skin punches were taken and the epidermal layer was removed. Permeation was deeper from the microemulsions, as compared to the cream and the microemulsion gels; additionally, penetration was deeper with the o/w formulations compared to the bicontinuous formulations. Deuterated ceramide NP in the cream did not permeate into the deeper layers of the stratum corneum and other skin layers. Permeation from the gel was shallow due to its high viscosity.

#### Polyglyceryl-10 Trioleate

The effect of Polyglyceryl-10 Trioleate on the permeation of tenoxicam (a non-steroidal anti-inflammatory drug) in a propylene glycol solution was examined *in vitro* using dorsal skin from male Hartley strain guinea pigs.<sup>37</sup>



**Figure 6.** Tenoxicam

The test solution was prepared by suspending 0.3 g tenoxicam in a mixed solution of 3.0 g propylene glycol and 1.5 g Polyglyceryl-10 Trioleate, and the suspension was adjusted to a pH of 6.0. Using a Franz-type diffusion chamber, 1 g of the resulting suspension, which contained 1% tenoxicam, 10% propylene glycol, and 5% Polyglyceryl-10 Trioleate, was applied to the donor skin, and 1.0 ml of the receptor solution was sampled every 3 h for 48 h. The flux of tenoxicam was statistically significantly enhanced by the inclusion of Polyglyceryl-10 Trioleate, from  $8.11 \times 10^{-5} \mu\text{g/s}\cdot\text{cm}^2$  to  $28.48 \mu\text{g/s}\cdot\text{cm}^2$ .

### **Absorption, Distribution, Metabolism, and Excretion (ADME)**

#### **Oral**

Metabolic studies of polyglyceryl esters indicated that these esters are hydrolyzed in the gastrointestinal (GI) tract, and utilization and digestibility studies supported the assumption that the fatty acid moiety is metabolized in the normal manner.<sup>27</sup> Analytical studies have produced no evidence of accumulation of the polyglycerol moiety in body tissues.

Albino Wistar rats were fed a diet containing 5% or 10% polyglyceryl ester; the exact composition of the ester was not provided, but it was stated that the ester was mostly prepared with stearic and oleic acids.<sup>28</sup> Control animals were given untreated feed. The number of animals per group and duration of dosing also was not specified, however some animals were fed the test diet for up to 14 mos, and some were maintained through 3 generations. Feed consumption was determined for 2 males and 2 females per group, and feces were collected for these animals for 24 days. Fecal lipids were increased in the test groups when compared to the controls; however, the researchers stated that at least 95-98% of the polyglyceryl esters were digested.

Similarly, groups of Wistar rats were fed a diet containing 5% polyglyceryl ester prepared with oleic acid or with linseed oil, and feed consumption was measured and feces collected for 2 males and 2 females per group for 24 days.<sup>28</sup> The polyglyceryl esters were almost completely utilized.

Groups of 8 male Sherman rats were fed a restricted diet consisting of 1 g of a polyglyceryl ester in 5 g basic diet/day for 3 wks, followed by 8 wks feeding, *ad libitum*, of a diet containing 8% of the test material.<sup>29</sup> The esters used in the study ranged in size from 2 to 30 glyceryl radicals, with hydrogenated cottonseed oil or peanut oil. Fecal fat excretion, calculated as total lipid extract, absorption, and digestibility values, were determined during the restricted and *ad libitum* feeding periods. The fecal lipids from rats fed the polyglyceryl hydrogenated cottonseed oil esters were higher in palmitic, stearic, and oleic acids, and lower in linoleic acid, than those the fed the polyglyceryl peanut oil esters. Gas-liquid chromatography (GLC) analysis of the fatty acids of the extracted lipids from the epididymal fat pads determined that only triglycerides were present and no appreciable amounts of polyglycerols were deposited.

A study was conducted in which rats were fed a polyglyceryl ester with a high melting point for 8 mos.<sup>30</sup> No residues were detected in depot fat, or in fat of muscle, liver, kidney or spleen. (Details were not provided.)

#### Polyglyceryl Oleates and Decaoleate

The metabolism of Polyglyceryl-3 Oleate, Polyglyceryl-10 Oleate, and Polyglyceryl-10 Decaoleate was investigated in male Sprague-Dawley rats.<sup>31</sup> Groups of 4 rats were dosed with 1% Polyglyceryl-3 [<sup>14</sup>C]Oleate, Polyglyceryl-10 [<sup>14</sup>C]Oleate, [<sup>14</sup>C]Polyglyceryl-10 Oleate, Polyglyceryl-10 [<sup>14</sup>C]Decaoleate, and [<sup>14</sup>C]Polyglyceryl-10 Decaoleate by stomach tube in a liquid diet; the diet contained 7-14  $\mu\text{Ci}$  of <sup>14</sup>C. The study also included 2 polyglyceryl esters that are not cosmetic ingredients, but are similar to ingredients reviewed in this report: triglycerol [<sup>14</sup>C]tetraoleate and polyglycerin-10 [<sup>14</sup>C]monoecicosanoate. Catabolism studies were conducted by administering the test diet, collecting expired CO<sub>2</sub>, feces, and urine with the use of metabolism chambers, and collecting GI tract contents and examining the carcass of each animal after 51 h. In additional groups of 4 animals, simultaneous catabolism-absorption studies were conducted by inserting a thoracic duct cannula in each animal, dosing the animals, and then using a metabolism chamber for the collection of lymph, respiratory CO<sub>2</sub>, feces, and urine (each as a single fraction) for 51 h. Lipids were extracted from the lymph of animals dosed with fatty-acid labelled esters to determine whether any intact polyglyceryl esters were present. The metabolism of the esters was also compared to glycerol-1,3-[<sup>14</sup>C], [<sup>14</sup>C]polyglycerin-3, and [<sup>14</sup>C]polyglycerin-10.



The disposition of radioactivity following administration of each compound is presented in Table 11. In the catabolism studies, total recovery of the radioactivity ranged from 88-98% of the dose. The distribution of the absorbed [ $^{14}\text{C}$ ]Polyglyceryl-10 Oleate and [ $^{14}\text{C}$ ]Polyglyceryl-10 Decaoleate was considerably different from that of glycerol. The absorbed polyglyceryls were excreted primarily in the urine (33.5-37%) with less than 4% of the  $^{14}\text{C}$  appearing in the respiratory  $\text{CO}_2$  and less than 5.5% in the carcass; ~44.5-46.5% was found in the GI contents. Only small amounts of radioactivity from the [ $^{14}\text{C}$ ]oleic acid moiety were recovered in feces (~0.1-0.9%) and GI content (~2.8-4.0%), and the fatty acid appeared to be equally well-absorbed as the polyglyceryl-3 and the polyglyceryl-10 ester. Radioactivity from labeled oleic acid moieties of the esters appeared in expired  $\text{CO}_2$  at close to the same rates as that from glycerol; however, recovery of labeled polyglycerin-3 and polyglycerin-10 in expired  $\text{CO}_2$  was less than 4% of the dose, with unpolymerized glycerol accounting for most of what was recovered. Radioactivity from the eicosanoic acid-labeled ester was excreted in  $\text{CO}_2$  at a lower rate (55.5%) than that for the oleic acid-labeled compounds.

In the catabolism-absorption studies, 83-102% of the radioactivity was recovered. No more than 5% of the glycerol-labeled esters were absorbed via the lymphatic system; however, ~67.5-78.5% of the radioactivity from the oleic acid-labeled polyglyceryl esters was recovered in the lymph, and ~54% was recovered in the lymph of animals given the eicosanoate-labeled polyglyceryl ester. Lipids from the oleate- (and eicosanoate-) labeled compounds contained 97-99% of the total lymph radioactivity.

*In vitro* hydrolysis studies confirmed that the oleic acid ester bond in the polyglyceryl-3 and polyglyceryl-10 esters was readily cleaved. Additionally, it was shown that the eicosanoate bond was cleaved more slowly than the oleate bond. The researchers concluded that the polyglycerols were not catabolized, the ether linkages are inert to normal enzymatic hydrolysis, and the polyglycerols were absorbed and rapidly excreted in the urine without being catabolized.

Groups of 10 male and 10 female Sprague-Dawley rats were fed a diet containing 2.5, 5.0, or 10.0% Polyglyceryl-10 Decaoleate for 90 days, and the control group was fed a diet containing soybean oil as the dietary fat.<sup>32</sup> The percentage of dietary fatty acids absorbed decreased as the levels of Polyglyceryl-10 Decaoleate in the diet increased. Fat absorption by males and females of the 5 and 10% test groups was statistically significantly less than controls at wks 4 and 10, and was statistically significantly decreased in females of the 2.5% group at wk 4 and males of the 2.5% group at wk 10. GLC analysis revealed excretion of oleic acid increased in a dose-related manner, indicating that the absorption of dietary Polyglyceryl-10 Decaoleate was not complete.

## **In Vitro**

### Polyglyceryl-2 Diisostearate

The metabolism of Polyglyceryl-2 Diisostearate was evaluated using a lipase assay; olive oil was used as a reference substance.<sup>33</sup> Both Polyglyceryl-2 Diisostearate and olive oil increased the fatty acid concentration in all reaction vials in a time dependent manner, and the speed of fatty acid formation was comparable for both substrates. The *in vitro* experimental results support the hypothesis that accumulation of Polyglyceryl-2 Diisostearate in the gut is unlikely.

## **TOXICOLOGICAL STUDIES**

### **Acute Toxicity**

Acute toxicity studies are summarized in Table 12.<sup>27,33,38-48</sup>

In an acute dermal toxicity study in rats, the  $\text{LD}_{50}$  of 1,2,3-propanetriol, homopolymer, diisooctadecanoate was >5 g/kg. Low toxicity was reported in acute oral studies. In rats, the  $\text{LD}_{50}$  >2 g/kg for Polyglyceryl-3 Caprate, Polyglyceryl-3 Caprylate, Polyglyceryl-4 Caprate, Diisostearoyl Polyglyceryl-3 dimer Dilinoleate, and the  $\text{LD}_{50}$  was >5 g/kg for Polyglyceryl-3 Iso-stearate, Polyglyceryl-3Oleate, Polyglyceryl-2 Diisostearate and Polyglyceryl-3 Diisostearate.

### **Short-Term Toxicity**

#### **Animal**

##### **Oral**

#### Polyglyceryl Esters - general

In rats, repeated oral dosing with 10 g/kg bw polyglyceryl ester daily over 5 days caused no deaths.<sup>27</sup> (No details were provided.)

The feeding of a restricted diet consisting of 1 g of a polyglyceryl ester in 5 g basic diet/day for 3 wks to Sherman rats, followed by 8 wks feeding, *ad libitum*, of a diet containing 8% of the test material (8 males/group; study described in the ADME section) did not result in any microscopic abnormalities in the liver, kidneys, or ileum.<sup>29</sup>

#### Polyglyceryl Stearate

Two groups of 4 male albino rats were administered a suspension of 1 g/kg bw/day of polyglyceryl stearate (glyceryl chain length not stated) in an aqueous solution of 0.5% carboxymethylcellulose (CMC) and 0.1% Tween 80 for 10 wks; one group was fed a basic diet, and the other a diet supplemented with 5% hydrogenated fat.<sup>49</sup> Two untreated control groups, one fed a



basal diet and one the fat-supplemented diet, were used. Polyglyceryl stearate was not toxic, and it did not have an effect on red blood cell count, white blood cell count, or hemoglobin values.

#### Polyglyceryl-2 Diisostearate

In a dietary study, 5 male and 5 female rats per group were given feed containing 0, 0.012, 0.12, or 1.2% Polyglyceryl-2 Diisostearate (for a targeted dose of 0, 10, 100, or 1000 mg/kg/day, respectively) for 28 days, and a control group was given untreated feed.<sup>33</sup> There were no mortalities, clinical signs of toxicity, effects on body weight, clinical pathology, or gross or histopathology alterations that were considered related to the dietary administration of the test substance and/or considered to be of toxicological significance. The no observed adverse effect level (NOAEL) was 845 mg/kg/day in males and 922 mg/kg/day in females, corresponding to the highest dietary concentration tested.

#### Human

##### **Oral**

#### Polyglyceryl Esters - general

For 3 wks, 37 subjects were fed 2-20 g/day polyglyceryl ester in their diet.<sup>27</sup> No abnormalities were detected in the hematology or clinical chemistry values or urinary or fecal parameters that were examined.

### **Subchronic Toxicity Studies**

#### Animal

##### **Oral**

#### Polyglyceryl-10 Decaoleate

Groups of 10 male and 10 female Sprague-Dawley rats were fed a diet containing 2.5, 5.0, or 10.0% Polyglyceryl-10 Decaoleate for 90 days, and the control group was fed a diet containing soybean oil as the dietary fat.<sup>32</sup> Urine was collected from each group during wks 3 and 9, total fatty acid absorption was determined in feces collected during wks 4 and 10, and hematological studies were conducted during wks 5 and 11, and at study termination. No test article-related signs of toxicity were observed. Gross and microscopic examination of the testes and ovaries and other organs did not reveal any signs of toxicity or microscopic lesions, and relative and absolute organ weights were unremarkable.

### **Chronic Toxicity Studies**

#### Animal

##### **Oral**

#### Polyglyceryl Esters - general

Groups of 25 male and 25 female mice were fed a diet with 5% polyglyceryl ester for 80 wks.<sup>27</sup> No adverse effects on body weight, feed consumption, hematology values, or survival rate were noted. Carcass fat of the test group showed no polyglycerol residues. The levels of free fatty acids, unsaponifiable material, and the fatty acid composition of carcass fat were the same for the test group compared to a control group fed 5% ground nut oil in the diet. The only differences noted in organ weights were for the liver and kidneys of female mice, which were significantly higher. Microscopic examination of all major organs showed nothing remarkable.

In the ADME study described previously, in which Wistar rats (number of animals per group not specified) were fed a diet containing 5 or 10% polyglyceryl ester (prepared mostly with stearic and oleic acid; duration of dosing not specified, however some animals were fed the test diet for up to 14 mos, and some were maintained through 3 generations), no abnormalities were observed upon microscopic examination of tissues (details not provided).<sup>28</sup>

### **DEVELOPMENTAL AND REPRODUCTIVE TOXICITY STUDIES**

##### **Oral**

#### Polyglyceryl Esters - general

A test group of 22 rats was fed a diet containing 1.5% polyglycerol for 3 generations.<sup>27</sup> A group of 28 rats was used as a control. The animals were kept for over 1 year without significant variation in fertility or reproductive performance. Gross and microscopic examination of the third generation revealed no consistent abnormality attributable to the test substance. No details were provided.

#### Polyglyceryl-3 Diisostearate

A combined repeated dose oral toxicity study with a reproduction/developmental toxicity screening test (OECD Guideline 422) was conducted in Wistar rats.<sup>38</sup> The animals were dosed once daily by gavage with 0, 100, 300, or 1000 mg/kg bw/day 1,2,3-propanetriol, homopolymer, diisooctadecanoate (n not defined; this substance is most likely Polyglyceryl-3 Diisostearate) in corn oil. Initially, the groups consisted of 12 males and 12 females. However, because a disturbance of the light/dark cycle was believed to cause a reduction in mating rate of the females of the first delivery, additional male and female rats were added in a second delivery for breeding to meet guideline requirements for the number of gravid females per group. All (1st and 2nd delivery) animals were subjected to the same conditions of the study, with the exception that the males of the

second delivery were necropsied on day 24 after mating, not on day 16 of mating. Therefore, Polyglyceryl-3 Diisostearate was administered to male rats for up to 28 days (first delivery) and up to 41 days (second delivery) and to female rats for 14 days prior to mating, through the mating and gestation periods, and until the F<sub>1</sub> generation reached day 4 post-partum.

Because an impact caused by the light/dark cycle disturbance could not be excluded (i.e., a prolonged duration of gestation and an increased post-implantation loss at the high dose), the study was repeated with a third delivery with control and high-dose groups under proper light conditions. The test article was administered to 12 male rats/group for 33 days and to 12 female rats/group for 14 days prior to mating, through mating and gestation, and until day 4 post-partum.

Five males and 5 females/group killed at the end of the study were selected for hematology and clinical chemistry examinations, and some additional organs were weighed. The NOEL and NOAEL for systemic effects were  $\geq 300$  mg/kg bw/day and  $\geq 1000$  mg/kg bw/day 1,2,3-propanetriol, homopolymer, diisooctadecanoate, respectively, in both males and females. No adverse effects on body weights and body weight gains, feed consumption, hematology, clinical chemistry, neurobehavior, or gross or microscopic lesions were observed. Statistically significant increases in absolute and relative liver and kidney weights in males and females of the 1000 mg/kg bw/day were not considered to be adverse effects because there was no evidence for an impairment of organ function by clinical pathology and histopathology. Additionally, increases in the absolute and relative heart weights in high-dose females were without histopathological correlation and considered to be incidental.

### **GENOTOXICITY STUDIES**

Genotoxicity studies are summarized in Table 13.<sup>20,33,38-44,46,50-52</sup>

Generally, negative results were obtained in genotoxicity tests. Polyglyceryl-2 Oleate, Polyglyceryl-2 Diisostearate, and 1,2,3-propanetriol, homopolymer, diisooctadecanoate were not genotoxic in the Ames test, mammalian cell gene mutation assay, or chromosomal aberration assay, with or without metabolic activation. Polyglyceryl-3 Caprate, Polyglyceryl-Caprylate, Polyglyceryl-3 Laurate, Polyglyceryl-3 Isostearate, Polyglyceryl-4 Caprate, Polyglyceryl-4 Isostearate, Polyglyceryl-4 Laurate/Succinate, and Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate were negative in the Ames test. Polyglyceryl-6 Caprylate/Caprate Polyglyceryl-10 Laurate (~60% pure) gave equivocal results in the absence and positive results in the presence of metabolic activation when tested at concentrations up to 125 and 2250  $\mu$ g/ml, respectively, in a chromosomal aberration assay using Chinese hamster V79 cells, but was not clastogenic in a chromosomal aberration assay in human peripheral lymphocytes, with or without activation.

According to the European Food Safety Authority (EFSA) Panel, the impurities of polyglyceryl fatty acid esters, i.e. free fatty acids and their esters, have no structural alerts for genotoxicity.<sup>23</sup>

### **CARCINOGENICITY STUDIES**

#### **Oral**

In a 2-yr study, 28 male and 28 female rats were fed 5% polyglyceryl ester in the diet.<sup>27</sup> No adverse effects on body weight, feed consumption, hematology values, or survival rate were noted. Liver function tests and renal function tests performed at 59 and 104 wks of the study were comparable between the test group and a control group fed 5% ground nut oil. The carcass fat contained no polyglycerol, and the levels of free fatty acid, unsaponifiable residue and fatty acid composition of carcass fat were not different from the controls. Organ weights, tumor incidence and tumor distribution were similar in control and test groups. A complete histological examination of major organs showed nothing remarkable.

### **DERMAL IRRITATION AND SENSITIZATION STUDIES**

Dermal irritation and sensitization studies are summarized in Table 14.<sup>33,38-45,45,46,50,53-62</sup>

Apricot Kernel Oil Polyglyceryl-4 Esters and Palm Oil Polyglyceryl-4 Esters were classified as non-irritant in the SkinEthic™ irritation test, and Polyglyceryl-4 Laurate/Sebacate, Polyglyceryl-4 Laurate/Succinate, and Polyglyceryl-6 Caprylate/Caprate were considered to be non-irritant in the EpiSkin™ model for skin irritation.

In rabbits, Polyglyceryl-3 Caprate, a polyglyceryl mono/diester of capric acid (read-across for Polyglyceryl-3 Caprylate), Polyglyceryl-4 Caprate, Polyglyceryl-3 Diisostearate and 1,2,3-propanetriol, homopolymer, diisooctadecanoate were not irritating to the skin. Polyglyceryl-2 Isostearate was mildly irritating, Polyglyceryl-2 Diisostearate was slightly irritating, and Polyglyceryl-3 Isostearate and Polyglyceryl-3 Oleate were moderate irritants in rabbit skin. Polyglyceryl-3 Caprate, Polyglyceryl-3 Caprylate, Polyglyceryl-3 Isostearate, Polyglyceryl-4 Caprate, Polyglyceryl-4 Isostearate, Polyglyceryl-2 Diisostearate, and Polyglyceryl-4 Diisostearate/Polyhydroxystearate/Sebacate (read-across for Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate) were not sensitizers in guinea pig studies. Polyglyceryl-3 Diisostearate was not a sensitizer in guinea pigs in one sensitization study (50% at induction and challenge; 25% at rechallenge), but results were inconclusive in a guinea pig maximization test (0.1% or 0.2% at intradermal induction; 40% at epicutaneous induction; 10 and 15% at challenge; 8 and 4% at rechallenge).

In a clinical study, 7% Polyglyceryl-2 Isostearate elicited slight irritation. In other studies, 10% Polyglyceryl-10 Myristate, 10% Polyglyceryl-10 Stearate, 20% active 1,2,3-propanetriol, homopolymer, diisooctadecanoate, 50% Polyglyceryl-10 Pentaisostearate, a mixture containing 60% Polyglyceryl-10 Eicosanedioate/Tetradecanedioate, and undiluted Polyglyceryl-2 Sesquiisostearate, Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate, and Polyglyceryl-10 Decaoleate were not irritants. Polyglyceryl-3 Laurate and undiluted Triisostearoyl Polyglyceryl-3 Dimer Dilinoleate were not irritants or sensitizers.

### **OCULAR IRRITATION STUDIES**

Ocular irritation studies are summarized in Table 15.<sup>20,33,36,38-47,58-60,63-67</sup>

Polyglyceryl-3 Laurate, a mixture containing 60% Polyglyceryl-10 Eicosanedioate/Tetradecanedioate, and Triisostearoyl Polyglyceryl-3 Dimer Dilinoleate (10% in corn oil) were classified as non-irritating using an EpiOcular™ tissue model. In the hen's egg test chorioallantoic membrane (HET-CAM) assay, microemulsions containing 30% or 40% Polyglyceryl-4 Laurate, Apricot Kernel Oil Polyglyceryl-4 Esters, Palm Oil Polyglyceryl-4 Esters, and Polyglyceryl-2 Dioleate were classified as non-irritant, and Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate produced minor irritation. Polyglyceryl-4 Laurate/Sebacate, Polyglyceryl-4 Laurate/Succinate, and Polyglyceryl-6 Caprylate/Caprates were considered non-irritant in the SkinEthic™ reconstituted human corneal epithelium model, and Polyglyceryl-10 Myristate, Polyglyceryl-10 Stearate, and Polyglyceryl-10 Diisostearate were non-irritating using the SIRC-neutral red (NR) method.

Polyglyceryl-3 Caprate, a polyglyceryl mono/diester of capric acid (read-across for Polyglyceryl-3 Caprylate), Polyglyceryl-4 Caprate, Polyglyceryl-2 Diisostearate, Polyglyceryl-2 Dioleate, Polyglyceryl-3 Diisostearate, and 1,2,3-propanetriol, homopolymer, diisooctadecanoate were not irritating to rabbit eyes, and Polyglyceryl-3 Isostearate and Polyglyceryl-3 Oleate were slightly irritating to rabbit eyes. Polyglyceryl-10 Laurate (~60% pure) was possibly slightly irritating to the eyes of humans.

### **CLINICAL REPORTS**

#### **Case Reports**

A case report described the incidence of recurring pruritic erythema over a 3-mo period in an 80-yr old female.<sup>68</sup> A 48-h closed patch test with the subject's cosmetics was positive (++). Subsequent testing with the individual ingredients was positive (+) with 0.5% aqueous (aq.) Polyglyceryl-10 Laurate, and the positive reaction caused by this substance was still present in this patient 7 days after exposure. Positive reactions (+) were reported at all concentrations with additional testing of 0.05-1% aq. Polyglyceryl-10 Laurate. After 6 mos, patch tests with 0.1-1% Polyglyceryl-10 Laurate (obtained from several suppliers), as well as to 0.5-1% Polyglyceryl-4 Laurate and Polyglyceryl-6 Laurate, were positive. No reactions were reported with 0.1-1% aq. Polyglyceryl-10 Myristate, Polyglyceryl-10 Isostearate, Polyglyceryl-10 Stearate, and Polyglyceryl-10 Oleate, or with the control test materials.

### **SUMMARY**

This assessment reviews the safety of 274 polyglyceryl fatty acid esters as used in cosmetics. Each of the esters in this group is a polyether comprising 2 to 20 glyceryl residues, end-capped by esterification with simple carboxylic acids, such as fatty acids. Most of these ingredients are reported to function in cosmetics as skin-conditioning agents and/or surfactants.

Seventy-four of the 274 ingredients included in this report are reported to be in use. Polyglyceryl-3 Diisostearate has the most reported uses (356, 260 of which are in lipsticks), and Polyglyceryl-4 Isostearate has the second highest number of reported uses (269). Polyglyceryl-2 Triisostearate and Polyglyceryl-3 Diisostearate have the highest concentration of use in a leave-on formulation; these ingredients are used at 40% and 39%, respectively. Many of these polyglyceryl fatty acid esters are used in products applied to the eye area, products that can result in incidental ingestion, or products that come into contact with mucous membranes, and a few of the polyglyceryl fatty acid esters are reported to be used in baby products. Additionally, some of the polyglyceryl fatty acid esters are used in cosmetic sprays and could possibly be inhaled.

Polyglyceryl esters of fatty acids, up to and including the decaglycerol esters, are permitted as multipurpose direct food additives. JECFA established an ADI of 0-25 mg/kg bw for polyglyceryl esters of fatty acids having an average chain length of up to 3 glycerol units, and an ADI of 0-7.5 mg/kg bw for polyglyceryl esters of interesterified ricinoleic acid. In the EU, the esters are listed as food additives at levels between 5000 and 10,000 mg/kg in certain foods, and up to 7% free glycerol/polyglycerol is allowed (i.e., 700 mg/kg).

Polyglyceryl esters are hydrolyzed in the GI tract, and the fatty acid moiety is metabolized in a normal manner. Analytical studies have produced no evidence of accumulation of the polyglycerol moiety in body tissues.

The ability to enhance skin penetration was examined for several of the polyglyceryl fatty acid esters. Polyglyceryl-3 Dioleate is reported to be a water-in-oil surfactant/solubilizer associated with enhanced drug penetration. Polyglyceryl-10 Trioleate enhanced the flux of tenoxicam in an *in vitro* study. Microemulsions containing Polyglyceryl-4 Laurate and Polyglyceryl-4 Oleate increased ceramide permeation into skin.

In an acute dermal toxicity study in rats, the LD<sub>50</sub> of 1,2,3-propanetriol, homopolymer, diisooctadecanoate was >5 g/kg. Low toxicity was reported in acute oral studies. In rats, the LD<sub>50</sub> >2 g/kg for Polyglyceryl-3 Caprate, Polyglyceryl-3 Caprylate, Polyglyceryl-4 Caprate, Diisostearoyl Polyglyceryl-3 dimer Dilinoleate, and the LD<sub>50</sub> was >5 g/kg for Polyglyceryl-3 Isostearate, Polyglyceryl-3 Oleate, Polyglyceryl-2 Diisostearate and Polyglyceryl-3 Diisostearate.

Dietary studies with polyglyceryl ester, polyglyceryl stearate, Polyglyceryl-2 Diisostearate, and Polyglyceryl-10 Decaoleate did not produce any remarkable effects. No test-article related adverse effects were observed in multi-generational studies with polyglyceryl esters or 1,2,3-propanetriol, homopolymer, diisooctadecanoate.

Generally, negative results were obtained in genotoxicity tests. Polyglyceryl-2 Oleate, Polyglyceryl-2 Diisostearate, and 1,2,3-propanetriol, homopolymer, diisooctadecanoate were not genotoxic in the Ames test, mammalian cell gene mutation assay, or chromosomal aberration assay, with or without metabolic activation. Polyglyceryl-3 Caprate, Polyglyceryl-3 Caprylate, Polyglyceryl-3 Laurate, Polyglyceryl-3 Isostearate, Polyglyceryl-4 Caprate, Polyglyceryl-4 Isostearate, Polyglyceryl-4 Laurate/Succinate, and Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate were negative in the Ames test. Polyglyceryl-6 Caprylate/Caprate and Polyglyceryl-10 Laurate (~60% pure) gave equivocal results in the absence and positive results in the presence of metabolic activation when tested at concentrations up to 125 and 2250 µg/ml, respectively, in a chromosomal aberration assay using Chinese hamster V79 cells, but were not clastogenic in a chromosomal aberration assay in human peripheral lymphocytes, with or without activation. The impurities of polyglyceryl fatty acid esters, i.e. free fatty acids and their esters, have no structural alerts for genotoxicity.

In a 2-yr dietary study in rats, 5% polyglyceryl ester was not carcinogenic and did not produce any adverse effects.

Apricot Kernel Oil Polyglyceryl-4 Esters and Palm Oil Polyglyceryl-4 Esters were classified as non-irritant in the SkinEthic<sup>TM</sup> irritation test, and Polyglyceryl-4 Laurate/Sebacate, Polyglyceryl-4 Laurate/Succinate, and Polyglyceryl-6 Caprylate/Caprate were considered to be non-irritant in the EpiSkin<sup>TM</sup> model for skin irritation. In rabbits, Polyglyceryl-3 Caprate, a polyglyceryl mono/diester of capric acid (read-across for Polyglyceryl-3 Caprylate), Polyglyceryl-4 Caprate, Polyglyceryl-3 Diisostearate and 1,2,3-propanetriol, homopolymer, diisooctadecanoate were not irritating to the skin. Polyglyceryl-2 Isostearate was mildly irritating, Polyglyceryl-2 Diisostearate was slightly irritating, and Polyglyceryl-3 Isostearate and Polyglyceryl-3 Oleate were moderate irritants in rabbit skin. Polyglyceryl-3 Caprate, Polyglyceryl-3 Caprylate, Polyglyceryl-3 Isostearate, Polyglyceryl-4 Caprate, Polyglyceryl-4 Isostearate, Polyglyceryl-2 Diisostearate, and Polyglyceryl-4 Diisostearate/Polyhydroxystearate/Sebacate (read-across for Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate) were not sensitizers in guinea pig studies. Polyglyceryl-3 Diisostearate was not a sensitizer in guinea pigs in one sensitization study (50% at induction and challenge; 25% at rechallenge), but results were inconclusive in a guinea pig maximization test (0.1% or 0.2% at intradermal induction; 40% at epicutaneous induction; 10 and 15% at challenge; 8 and 4% at rechallenge) in which positive results were observed in both test and control animals.

In a clinical study, 7% Polyglyceryl-2 Isostearate elicited slight irritation. In other studies, 10% Polyglyceryl-10 Myristate, 10% Polyglyceryl-10 Stearate, 20% active 1,2,3-propanetriol, homopolymer, diisooctadecanoate, 50% Polyglyceryl-10 Pentaistearate, a mixture containing 60% Polyglyceryl-10 Eicosanedioate/Tetradecanedioate, and undiluted Polyglyceryl-2 Sesquiisostearate, Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate, and Polyglyceryl-10 Decaoleate were not irritants. Polyglyceryl-3 Laurate and undiluted Triisostearoyl Polyglyceryl-3 Dimer Dilinoleate were not irritants or sensitizers.

Polyglyceryl-3 Laurate, a mixture containing 60% Polyglyceryl-10 Eicosanedioate/Tetradecanedioate, and Triisostearoyl Polyglyceryl-3 Dimer Dilinoleate (10% in corn oil) were classified as non-irritating using an EpiOcular<sup>TM</sup> tissue model. In the hen's egg test chorioallantoic membrane (HET-CAM) assay, microemulsions containing 30% or 40% Polyglyceryl-4 Laurate, Apricot Kernel Oil Polyglyceryl-4 Esters, Palm Oil Polyglyceryl-4 Esters, and Polyglyceryl-2 Dioleate were classified as non-irritant, and Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate produced minor irritation. Polyglyceryl-4 Laurate/Sebacate, Polyglyceryl-4 Laurate/Succinate, and Polyglyceryl-6 Caprylate/Caprate were considered non-irritant in the SkinEthic<sup>TM</sup> reconstituted human corneal epithelium model, and Polyglyceryl-10 Myristate, Polyglyceryl-10 Stearate, and Polyglyceryl-10 Diisostearate were non-irritating using the SIRC-neutral red (NR) method.

Polyglyceryl-3 Caprate, a polyglyceryl mono/diester of capric acid (read-across for Polyglyceryl-3 Caprylate), Polyglyceryl-4 Caprate, Polyglyceryl-2 Diisostearate, Polyglyceryl-2 Dioleate, Polyglyceryl-3 Diisostearate, and 1,2,3-propanetriol, homopolymer, diisooctadecanoate were not irritating to rabbit eyes, and Polyglyceryl-3 Isostearate and Polyglyceryl-3 Oleate were slightly irritating to rabbit eyes. Polyglyceryl-10 Laurate (~60% pure) was possibly slightly irritating to the eyes of humans.

## **DISCUSSION**

The ingredients in this report are esterification products of polyglycerin chains and fatty acids that vary in numbers of glycerin and fatty-acid equivalents and lengths of the fatty acids. The polymerization process used to produce polyglycerol yields a distribution of oligomers with primarily linear structures. In addition to the linear configuration, a significant part of the polyglycerol is of the branched types, e.g., originating from 1,2- and 2,2-O-ether linkages.

The Panel acknowledged this is a very large group of ingredients; however these ingredients are extensively metabolized to common nutrients and physiologic intermediates, therefore the Panel was satisfied that the data included in the report could be used to assess the safety of all the ingredients. Furthermore, the Panel has reviewed previously the safety of numerous ingredients that serve as starting materials for the synthesis of polyglyceryl fatty acid esters. These previously-reviewed ingredients, which can be residual impurities in the polyglyceryl esters products or potential metabolites (e.g., glycerin and free fatty acids released by the action of esterases in the skin), were found safe as used (or safe when formulated to be non-irritating) in cosmetic formulations.

Some of these ingredients can enhance the penetration of other ingredients through the skin. The Panel cautioned that care should be taken in formulating cosmetic products that may contain these ingredients in combination with any ingredients whose safety was based on their lack of dermal absorption data, or when dermal absorption was a concern.

It was noted that some of these ingredients are derived from plants. The Panel expressed concern about pesticide residues and heavy metals that may be present in botanical ingredients, and stressed that the cosmetics industry should continue to use the necessary procedures to limit these impurities in the ingredient before blending into cosmetic formulations.

The Panel was concerned that the potential exists for dermal irritation with the use of products formulated using some of the polyglyceryl fatty acid esters. The Panel specified that products containing these ingredients must be formulated to be non-irritating.

Additionally, the Panel discussed the issue of incidental inhalation exposure of some polyglyceryl fatty acid esters, as some of the polyglyceryl fatty acid esters are used in cosmetic sprays and could possibly be inhaled. For example, Polyglyceryl-3 Distearate is reported to be used at 3% spray body and hand creams. The Panel noted that droplets/particles from spray cosmetic products would not be respirable to any appreciable amount. Furthermore, droplets/particles deposited in the nasopharyngeal or bronchial regions of the respiratory tract present no toxicological concerns based on the chemical and biological properties of these ingredients. Coupled with the small actual exposure in the breathing zone and the concentrations at which the ingredients are used, the available information indicates that incidental inhalation would not be a significant route of exposure that might lead to local respiratory or systemic effects. A detailed discussion and summary of the Panel's approach to evaluating incidental inhalation exposures to ingredients in cosmetic products is available at <http://www.cir-safety.org/cir-findings>.

## **CONCLUSION**

The CIR Expert Panel concluded that the 274 polyglyceryl fatty acid esters listed below are safe in cosmetics in the present practices of use and concentration described in this safety assessment when formulated to be non-irritating:

Adansonia Digitata Seed Oil Polyglyceryl-6 Esters*	Macadamia Seed Oil Polyglyceryl 6 Esters Behenate
Almond Oil/Polyglyceryl-10 Esters*	Mauritia Flexuosa Seed Oil Polyglyceryl-6 Esters*
Apricot Kernel Oil Polyglyceryl-3 Esters*	Olive Oil Polyglyceryl-3 Esters*
Apricot Kernel Oil Polyglyceryl-4 Esters*	Olive Oil Polyglyceryl-4 Esters*
Apricot Kernel Oil Polyglyceryl-5 Esters*	Olive Oil Polyglyceryl-6 Esters*
Apricot Kernel Oil Polyglyceryl-6 Esters*	Palm Kernel Oil Polyglyceryl-4 Esters*
Apricot Kernel Oil Polyglyceryl-10 Esters*	Palm Oil Polyglyceryl-3 Esters*
Argan Oil Polyglyceryl-6 Esters*	Palm Oil Polyglyceryl-4 Esters
Astrocaryum Vulgare Oil Polyglyceryl-6 Esters*	Palm Oil Polyglyceryl-5 Esters*
Avocado Oil Polyglyceryl-6 Esters*	Palm Oil Polyglyceryl-6 Esters*
Babassu Oil Polyglyceryl-4 Esters	Parinari Curatellifolia Oil Polyglyceryl-6 Esters*
Babassu Oil Polyglyceryl-6 Esters	Pinus Sibirica Seed Oil Polyglyceryl-6 Esters*
Bertholletia Excelsa Seed Oil Polyglyceryl-6 Esters*	Polyglyceryl-2 Caprate
Borage Seed Oil Polyglyceryl-4 Esters*	Polyglyceryl-2 Caprylate*
Borage Seed Oil Polyglyceryl-6 Esters*	Polyglyceryl-2 Diisostearate
Candelilla/Jobba/Rice Bran Polyglyceryl-3 Esters	Polyglyceryl-2 Dioleate*
Caprylic/Capric Glycerides Polyglyceryl-10 Esters*	Polyglyceryl-2 Distearate*
Carapa Guaianensis Oil Polyglyceryl-6 Esters*	Polyglyceryl-2 Isopalmitate
Castor Oil Polyglyceryl-6 Esters*	Polyglyceryl-2 Isopalmitate/Sebacate*
Cocoa Butter Polyglyceryl-6 Esters*	Polyglyceryl-2 Isostearate
Coconut Oil Polyglyceryl-6 Esters	Polyglyceryl-2 Laurate
Coffee Seed Oil Polyglyceryl-6 Esters*	Polyglyceryl-2 Myristate*
Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate	Polyglyceryl-2 Oleate
Glycerol/Polyglyceryl-6 Isostearate/Behenate Esters	Polyglyceryl-2 Palmitate*
Hazelnut Seed Oil Polyglyceryl-6 Esters*	Polyglyceryl-2 Sesquicaprylate*
Linseed Oil Polyglyceryl-4 Esters*	Polyglyceryl-2 Sesquiisostearate
Macadamia Seed Oil Polyglyceryl 6 Esters*	Polyglyceryl-2 Sesquioleate*

Polyglyceryl-2 Sesquistearate  
Polyglyceryl-2 Stearate  
Polyglyceryl-2 Tetrabehenate/ Macadamate/Sebacate\*  
Polyglyceryl-2 Tetraisostearate  
Polyglyceryl-2 Tetraoleate\*  
Polyglyceryl-2 Tetrastearate\*  
Polyglyceryl-2 Triisostearate  
Polyglyceryl-3 Beeswax  
Polyglyceryl-3 Behenate\*  
Polyglyceryl-3 Caprate  
Polyglyceryl-3 Caprylate  
Polyglyceryl-3 Cocoate\*  
Polyglyceryl-3 Dicaprate\*  
Polyglyceryl-3 Dicitrate/Stearate  
Polyglyceryl-3 Dicoate\*  
Polyglyceryl-3 Di Hydroxystearate\*  
Polyglyceryl-3 Diisostearate  
Polyglyceryl-3 Dioleate\*  
Polyglyceryl-3 Distearate  
Polyglyceryl-3 Isostearate  
Polyglyceryl-3 Laurate  
Polyglyceryl-3 Myristate\*  
Polyglyceryl-3 Oleate  
Polyglyceryl-3 Palmitate\*  
Polyglyceryl-3 Pentacaprylate/Caprate\*  
Polyglyceryl-3 Pentaolive\*  
Polyglyceryl-3 Pentaricinoleate  
Polyglyceryl-3 Rice Branate\*  
Polyglyceryl-3 Ricinoleate  
Polyglyceryl-3 Soyate/Shea Butterate\*  
Polyglyceryl-3 Stearate  
Polyglyceryl-3 Stearate SE\*  
Polyglyceryl-3 Triisostearate\*  
Polyglyceryl-3 Triolive\*  
Polyglyceryl-4 Almond/Shea Butterate\*  
Polyglyceryl-4 Caprate  
Polyglyceryl-4 Caprylate\*  
Polyglyceryl-4 Caprylate/Caprate\*  
Polyglyceryl-4 Cocoate\*  
Polyglyceryl-4 Dilaurate\*  
Polyglyceryl-4 Distearate\*  
Polyglyceryl-4 Hazelnutseedate\*  
Polyglyceryl-4 Isostearate  
Polyglyceryl-4 Isostearate/Laurate\*  
Polyglyceryl-4 Laurate  
Polyglyceryl-4 Laurate/Sebacate\*  
Polyglyceryl-4 Laurate/Succinate\*  
Polyglyceryl-4 Oleate  
Polyglyceryl-4 Pentaoleate\*  
Polyglyceryl-4 Pentapalmitate/Stearate\*  
Polyglyceryl-4 Pentastearate\*  
Polyglyceryl-4 Punicate\*  
Polyglyceryl-4 Stearate\*  
Polyglyceryl-4 Sweet Almond\*  
Polyglyceryl-4 Tristearate\*  
Polyglyceryl-5 Caprate\*  
Polyglyceryl-5 Dicaprylate\*  
Polyglyceryl-5 Dilaurate\*  
Polyglyceryl-5 Dioleate

Polyglyceryl-5 Hexastearate\*  
Polyglyceryl-5 Isostearate  
Polyglyceryl-5 Laurate  
Polyglyceryl-5 Myristate\*  
Polyglyceryl-5 Oleate  
Polyglyceryl-5 Pentamylristate\*  
Polyglyceryl-5 Ricinoleate\*  
Polyglyceryl-5 Stearate  
Polyglyceryl-5 Tribehenate\*  
Polyglyceryl-5 Triisostearate  
Polyglyceryl-5 Trimylristate\*  
Polyglyceryl-5 Trioleate  
Polyglyceryl-5 Tristearate\*  
Polyglyceryl-6 Adansonia Digitata Seedate\*  
Polyglyceryl-6 Apricot Kernelate\*  
Polyglyceryl-6 Argan Kernelate\*  
Polyglyceryl-6 Behenate\*  
Polyglyceryl-6 Caprate\*  
Polyglyceryl-6 Caprylate\*  
Polyglyceryl-6 Caprylate/Caprate  
Polyglyceryl-6 Citrullus Lanatus Seedate\*  
Polyglyceryl-6 Dicaprate\*  
Polyglyceryl-6 Diisostearate\*  
Polyglyceryl-6 Dioleate  
Polyglyceryl-6 Dipalmitate\*  
Polyglyceryl-6 Distearate  
Polyglyceryl-6 Heptacaprylate\*  
Polyglyceryl-6 Hexaoleate\*  
Polyglyceryl-6 Hexastearate\*  
Polyglyceryl-6 Isostearate  
Polyglyceryl-6 Laurate\*  
Polyglyceryl-6 Myristate\*  
Polyglyceryl-6 Octacaprylate\*  
Polyglyceryl-6 Octastearate  
Polyglyceryl-6 Oleate  
Polyglyceryl-6 Palmitate\*  
Polyglyceryl-6 Palmitate/Succinate\*  
Polyglyceryl-6 Pentacaprylate\*  
Polyglyceryl-6 Pentaoleate\*  
Polyglyceryl-6 Pentaricinoleate\*  
Polyglyceryl-6 Pentastearate  
Polyglyceryl-6 Ricinoleate  
Polyglyceryl-6 Schinziophyton Rautanenii Kernelate\*  
Polyglyceryl-6 Sclerocarya Birrea Seedate\*  
Polyglyceryl-6 Sesquicaprylate\*  
Polyglyceryl-6 Sesquiisostearate\*  
Polyglyceryl-6 Sesquistearate\*  
Polyglyceryl-6 Stearate\*  
Polyglyceryl-6 Tetrabehenate\*  
Polyglyceryl-6 Tetracaprylate\*  
Polyglyceryl-6 Tetraoleate\*  
Polyglyceryl-6 Tricaprylate  
Polyglyceryl-6 Trichilia Emetica Seedate\*  
Polyglyceryl-6 Tristearate\*  
Polyglyceryl-6 Undecylenate\*  
Polyglyceryl-6 Ximenia Americana Seedate\*  
Polyglyceryl-8 C12-20 Acid Ester\*  
Polyglyceryl-8 Decabehenate/Caprate  
Polyglyceryl-8 Decaerucate/Decaisostearate/ Decaricinoleate

Polyglyceryl-8 Oleate\*  
 Polyglyceryl-8 Stearate\*  
 Polyglyceryl-10 Apricot Kernelate\*  
 Polyglyceryl-10 Behenate/Eicosadioate  
 Polyglyceryl-10 Caprate\*  
 Polyglyceryl-10 Caprylate\*  
 Polyglyceryl-10 Caprylate/Caprate\*  
 Polyglyceryl-10 Cocoate\*  
 Polyglyceryl-10 Decaethylhexanoate\*  
 Polyglyceryl-10 Decahydroxystearate\*  
 Polyglyceryl-10 Decaisostearate  
 Polyglyceryl-10 Decalinoleate\*  
 Polyglyceryl-10 Decamacadamiate\*  
 Polyglyceryl-10 Decaoleate  
 Polyglyceryl-10 Decastearate\*  
 Polyglyceryl-10 Dicocoate\*  
 Polyglyceryl-10 Didecanoate\*  
 Polyglyceryl-10 Diisostearate  
 Polyglyceryl-10 Dilaurate\*  
 Polyglyceryl-10 Dimyristate\*  
 Polyglyceryl-10 Dioleate  
 Polyglyceryl-10 Dipalmitate  
 Polyglyceryl-10 Distearate  
 Polyglyceryl-10 Dodecabeheate\*  
 Polyglyceryl-10 Dodecacaprate\*  
 Polyglyceryl-10 Dodecacaprylate\*  
 Polyglyceryl-10 Dodeca-Caprylate/ Caprate\*  
 Polyglyceryl-10 Eicosanedioate/Tetradecanedioate\*  
 Polyglyceryl-10 Hepta(Behenate/Stearate)\*  
 Polyglyceryl-10 Heptahydroxystearate  
 Polyglyceryl-10 Heptaoleate\*  
 Polyglyceryl-10 Heptastearate\*  
 Polyglyceryl-10 Hexaerucate\*  
 Polyglyceryl-10 Hexaisostearate\*  
 Polyglyceryl-10 Hexaoleate\*  
 Polyglyceryl-10 Hydroxystearate/Stearate/Eicosadioate  
 Polyglyceryl-10 Isostearate  
 Polyglyceryl-10 Laurate  
 Polyglyceryl-10 Linoleate\*  
 Polyglyceryl-10 Mono/Dioleate\*  
 Polyglyceryl-10 Myristate  
 Polyglyceryl-10 Nonaerucate\*  
 Polyglyceryl-10 Nonaisostearate  
 Polyglyceryl-10 Oleate  
 Polyglyceryl-10 Palmate\*  
 Polyglyceryl-10 Palmitate\*  
 Polyglyceryl-10 Pentacaprylate\*  
 Polyglyceryl-10 Pentahydroxystearate  
 Polyglyceryl-10 Pentaisostearate  
 Polyglyceryl-10 Pentalaurate\*  
 Polyglyceryl-10 Pentalinoleate\*

Polyglyceryl-10 Pentaoleate  
 Polyglyceryl-10 Pentaricinoleate\*  
 Polyglyceryl-10 Pentastearate  
 Polyglyceryl-10 Sesquistearate\*  
 Polyglyceryl-10 Stearate  
 Polyglyceryl-10 Tetradecanedioate\*  
 Polyglyceryl-10 Tetralaurate\*  
 Polyglyceryl-10 Tetraoleate\*  
 Polyglyceryl-10 Tricocoate\*  
 Polyglyceryl-10 Tridecanoate\*  
 Polyglyceryl-10 Trierucate\*  
 Polyglyceryl-10 Triisostearate\*  
 Polyglyceryl-10 Trilaurate\*  
 Polyglyceryl-10 Trioleate\*  
 Polyglyceryl-10 Tristearate  
 Polyglyceryl-10 Undecylenate\*  
 Polyglyceryl-15 Diisostearate\*  
 Polyglyceryl-20 Docosabeheate/Isostearate\*  
 Polyglyceryl-20 Docosabeheate/Laurate\*  
 Polyglyceryl-20 Docosabeheate/Oleate\*  
 Polyglyceryl-20 Heptacaprylate\*  
 Polyglyceryl-20 Heptadecabeheate/Laurate\*  
 Polyglyceryl-20 Hexacaprylate\*  
 Polyglyceryl-20 Octadecabeheate/Laurate\*  
 Polyglyceryl-20 Octaisononanoate\*  
 Pumpkin Seed Oil Polyglyceryl-4 Esters\*  
 Pumpkin Seed Oil Polyglyceryl-4 Esters Succinate\*  
 Rice Bran Oil Polyglyceryl-3 Esters\*  
 Rosa Rubiginosa Seed Oil Polyglyceryl-6 Esters\*  
 Safflower Seed Oil Polyglyceryl-6 Esters\*  
 Schinziophyton Rautanenii Kernel Oil Polyglyceryl-6 Esters\*  
 Sclerocarya Birrea Seed Oil Polyglyceryl-6 Esters\*  
 Sclerocarya Birrea Seed Oil Polyglyceryl-10 Esters\*  
 Sesame Oil Polyglyceryl-6 Esters\*  
 Shea Butter Polyglyceryl-3 Esters\*  
 Shea Butter Polyglyceryl-4 Esters\*  
 Shea Butter Polyglyceryl-6 Esters\*  
 Soybean Oil Polyglyceryl-6 Esters\*  
 Sunflower Seed Oil Polyglyceryl 3 Esters\*  
 Sunflower Seed Oil Polyglyceryl-4 Esters\*  
 Sunflower Seed Oil Polyglyceryl-5 Esters\*  
 Sunflower Seed Oil Polyglyceryl 6 Esters\*  
 Sunflower Seed Oil Polyglyceryl 10 Esters\*  
 Sweet Almond Oil Polyglyceryl-4 Esters\*  
 Sweet Almond Oil Polyglyceryl-6 Esters\*  
 Theobroma Grandiflorum Seed Butter Polyglyceryl-6 Esters\*  
 Trichilia Emetica Seed Oil Polyglyceryl-6 Esters\*  
 Triisostearoyl Polyglyceryl-3 Dimer Dilinoleate  
 Watermelon Seed Oil Polyglyceryl-6 Esters \*  
 Watermelon Seed Oil Polyglyceryl-10 Esters\*  
 Ximenia Americana Seed Oil Polyglyceryl-6 Esters\*

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



## TABLES

**Table 1. Polyglyceryl Fatty Acid Esters – presented alphabetically**

Adansonia Digitata Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-3 Di-Hydroxystearate
Almond Oil/Polyglyceryl-10 Esters	Polyglyceryl-3 Diisostearate
Apricot Kernel Oil Polyglyceryl-3 Esters	Polyglyceryl-3 Dioleate
Apricot Kernel Oil Polyglyceryl-4 Esters	Polyglyceryl-3 Distearate
Apricot Kernel Oil Polyglyceryl-5 Esters	Polyglyceryl-3 Isostearate
Apricot Kernel Oil Polyglyceryl-6 Esters	Polyglyceryl-3 Laurate
Apricot Kernel Oil Polyglyceryl-10 Esters	Polyglyceryl-3 Myristate
Argan Oil Polyglyceryl-6 Esters	Polyglyceryl-3 Oleate
Astrocaryum Vulgare Oil Polyglyceryl-6 Esters	Polyglyceryl-3 Palmitate
Avocado Oil Polyglyceryl-6 Esters	Polyglyceryl-3 Pentacaprylate/Caprates
Babassu Oil Polyglyceryl-4 Esters	Polyglyceryl-3 Pentaoliveate
Babassu Oil Polyglyceryl-6 Esters	Polyglyceryl-3 Pentaricinoleate
Bertholletia Excelsa Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-3 Rice Branate
Borage Seed Oil Polyglyceryl-4 Esters	Polyglyceryl-3 Ricinoleate
Borage Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-3 Soyate/Shea Butterate
Candelilla/Jojoba/Rice Bran Polyglyceryl-3 Esters	Polyglyceryl-3 Stearate
Caprylic/Capric Glycerides Polyglyceryl-10 Esters	Polyglyceryl-3 Stearate SE
Carapa Guaianensis Oil Polyglyceryl-6 Esters	Polyglyceryl-3 Triisostearate
Castor Oil Polyglyceryl-6 Esters	Polyglyceryl-3 Trioliveate
Cocoa Butter Polyglyceryl-6 Esters	Polyglyceryl-4 Almond/Shea Butterate
Coconut Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Caprate
Coffee Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Caprylate
Diisostearyl Polyglyceryl-3 Dimer Dilinoleate	Polyglyceryl-4 Caprylate/Caprates
Glycerol/Polyglyceryl-6 Isostearate/Behenate Esters	Polyglyceryl-4 Cocoate
Hazelnut Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Dilaurate
Linseed Oil Polyglyceryl-4 Esters	Polyglyceryl-4 Distearate
Macadamia Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Hazelnutseedate
Macadamia Seed Oil Polyglyceryl-6 Esters Behenate	Polyglyceryl-4 Isostearate
Mauritia Flexuosa Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Isostearate/Laurate
Olive Oil Polyglyceryl-3 Esters	Polyglyceryl-4 Laurate
Olive Oil Polyglyceryl-4 Esters	Polyglyceryl-4 Laurate/Sebacate
Olive Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Laurate/Succinate
Palm Kernel Oil Polyglyceryl-4 Esters	Polyglyceryl-4 Oleate
Palm Oil Polyglyceryl-3 Esters	Polyglyceryl-4 Pentaoleate
Palm Oil Polyglyceryl-4 Esters	Polyglyceryl-4 Pentapalmitate/Stearate
Palm Oil Polyglyceryl-5 Esters	Polyglyceryl-4 Pentastearate
Palm Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Punicate
Parinari Curatellifolia Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Stearate
Pinus Sibirica Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Sweet Almond/ate
Polyglyceryl-2 Caprate	Polyglyceryl-4 Tristearate
Polyglyceryl-2 Caprylate	Polyglyceryl-5 Caprate
Polyglyceryl-2 Diisostearate	Polyglyceryl-5 Dicaprylate
Polyglyceryl-2 Dioleate	Polyglyceryl-5 Dilaurate
Polyglyceryl-2 Distearate	Polyglyceryl-5 Dioleate
Polyglyceryl-2 Isopalmitate	Polyglyceryl-5 Hexastearate
Polyglyceryl-2 Isopalmitate/Sebacate	Polyglyceryl-5 Isostearate
Polyglyceryl-2 Isostearate	Polyglyceryl-5 Laurate
Polyglyceryl-2 Laurate	Polyglyceryl-5 Myristate
Polyglyceryl-2 Myristate	Polyglyceryl-5 Oleate
Polyglyceryl-2 Oleate	Polyglyceryl-5 Pentamyristate
Polyglyceryl-2 Palmitate	Polyglyceryl-5 Ricinoleate
Polyglyceryl-2 Sesquicaprylate	Polyglyceryl-5 Stearate
Polyglyceryl-2 Sesquiisostearate	Polyglyceryl-5 Tribehenate
Polyglyceryl-2 Sesquioleate	Polyglyceryl-5 Triisostearate
Polyglyceryl-2 Sesquisteate	Polyglyceryl-5 Trimyristate
Polyglyceryl-2 Stearate	Polyglyceryl-5 Trioleate
Polyglyceryl-2 Tetrabehenate/ Macadamiate/Sebacate	Polyglyceryl-5 Tristearate
Polyglyceryl-2 Tetraistearate	Polyglyceryl-6 Adansonia Digitata Seedate
Polyglyceryl-2 Tetraoleate	Polyglyceryl-6 Apricot Kernelate
Polyglyceryl-2 Tetrastearate	Polyglyceryl-6 Argan Kernelate
Polyglyceryl-2 Triisostearate	Polyglyceryl-6 Behenate
Polyglyceryl-3 Beeswax	Polyglyceryl-6 Caprate
Polyglyceryl-3 Behenate	Polyglyceryl-6 Caprylate
Polyglyceryl-3 Caprate	Polyglyceryl-6 Caprylate/Caprates
Polyglyceryl-3 Caprylate	Polyglyceryl-6 Citrullus Lanatus Seedate
Polyglyceryl-3 Cocoate	Polyglyceryl-6 Dicaprate
Polyglyceryl-3 Dicaprate	Polyglyceryl-6 Diisostearate
Polyglyceryl-3 Dicitrate/Stearate	Polyglyceryl-6 Dioleate
Polyglyceryl-3 Dicocoate	Polyglyceryl-6 Dipalmitate

Polyglyceryl-6 Distearate  
Polyglyceryl-6 Heptacaprylate  
Polyglyceryl-6 Hexaoleate  
Polyglyceryl-6 Hexastearate  
Polyglyceryl-6 Isostearate  
Polyglyceryl-6 Laurate  
Polyglyceryl-6 Myristate  
Polyglyceryl-6 Octacaprylate  
Polyglyceryl-6 Octastearate  
Polyglyceryl-6 Oleate  
Polyglyceryl-6 Palmitate  
Polyglyceryl-6 Palmitate/Succinate  
Polyglyceryl-6 Pentacaprylate  
Polyglyceryl-6 Pentaoleate  
Polyglyceryl-6 Pentaricinoleate  
Polyglyceryl-6 Pentastearate  
Polyglyceryl-6 Ricinoleate  
Polyglyceryl-6 Schinziophyton Rautanenii Kernelate  
Polyglyceryl-6 Sclerocarya Birrea Seedate  
Polyglyceryl-6 Sesquicaprylate  
Polyglyceryl-6 Sesquiosostearate  
Polyglyceryl-6 Sesquisteate  
Polyglyceryl-6 Stearate  
Polyglyceryl-6 Tetrabenenate  
Polyglyceryl-6 Tetracaprylate  
Polyglyceryl-6 Tetraoleate  
Polyglyceryl-6 Tricaprylate  
Polyglyceryl-6 Trichilia Emetica Seedate  
Polyglyceryl-6 Tristearate  
Polyglyceryl-6 Undecylenate  
Polyglyceryl-6 Ximenia Americana Seedate  
Polyglyceryl-8 C12-20 Acid Ester  
Polyglyceryl-8 Decabenenate/Caprates  
Polyglyceryl-8 Decaerucate/Decaisostearate/ Decaricinoleate  
Polyglyceryl-8 Oleate  
Polyglyceryl-8 Stearate  
Polyglyceryl-10 Apricot Kernelate  
Polyglyceryl-10 Behenate/Eicosadioate  
Polyglyceryl-10 Caprate  
Polyglyceryl-10 Caprylate  
Polyglyceryl-10 Caprylate/Caprates  
Polyglyceryl-10 Cocoate  
Polyglyceryl-10 Decaethylhexanoate  
Polyglyceryl-10 Decahydroxystearate  
Polyglyceryl-10 Decaisostearate  
Polyglyceryl-10 Decalinoleate  
Polyglyceryl-10 Decamacadamiate  
Polyglyceryl-10 Decaoleate  
Polyglyceryl-10 Decastearate  
Polyglyceryl-10 Dicoate  
Polyglyceryl-10 Didecanoate  
Polyglyceryl-10 Diisostearate  
Polyglyceryl-10 Dilaurate  
Polyglyceryl-10 Dimyristate  
Polyglyceryl-10 Dioleate  
Polyglyceryl-10 Dipalmitate  
Polyglyceryl-10 Distearate  
Polyglyceryl-10 Dodecabehenate  
Polyglyceryl-10 Dodecacaprates  
Polyglyceryl-10 Dodecacaprylate  
Polyglyceryl-10 Dodeca-Caprylate/ Caprates  
Polyglyceryl-10 Eicosanedioate/Tetradecanedioate  
Polyglyceryl-10 Hepta(Behenate/Stearate)  
Polyglyceryl-10 Heptahydroxystearate  
Polyglyceryl-10 Heptaoleate  
Polyglyceryl-10 Heptastearate  
Polyglyceryl-10 Hexaerucate  
Polyglyceryl-10 Hexaisostearate

---

Polyglyceryl-10 Hexaoleate  
Polyglyceryl-10 Hydroxystearate/Stearate/Eicosadioate  
Polyglyceryl-10 Isostearate  
Polyglyceryl-10 Laurate  
Polyglyceryl-10 Linoleate  
Polyglyceryl-10 Mono/Dioleate  
Polyglyceryl-10 Myristate  
Polyglyceryl-10 Nonaerucate  
Polyglyceryl-10 Nonaisostearate  
Polyglyceryl-10 Oleate  
Polyglyceryl-10 Palmate  
Polyglyceryl-10 Palmitate  
Polyglyceryl-10 Pentacaprylate  
Polyglyceryl-10 Pentahydroxystearate  
Polyglyceryl-10 Pentaistostearate  
Polyglyceryl-10 Pentalaurate  
Polyglyceryl-10 Pentalinoleate  
Polyglyceryl-10 Pentaoleate  
Polyglyceryl-10 Pentaricinoleate  
Polyglyceryl-10 Pentastearate  
Polyglyceryl-10 Sesquisteate  
Polyglyceryl-10 Stearate  
Polyglyceryl-10 Tetradecanedioate  
Polyglyceryl-10 Tetralaurate  
Polyglyceryl-10 Tetraoleate  
Polyglyceryl-10 Tricocoate  
Polyglyceryl-10 Tridecanoate  
Polyglyceryl-10 Trierucate  
Polyglyceryl-10 Triisostearate  
Polyglyceryl-10 Trilaurate  
Polyglyceryl-10 Trioleate  
Polyglyceryl-10 Tristearate  
Polyglyceryl-10 Undecylenate  
Polyglyceryl-15 Diisostearate  
Polyglyceryl-20 Docosabehenate/Isostearate  
Polyglyceryl-20 Docosabehenate/Laurate  
Polyglyceryl-20 Docosabehenate/Oleate  
Polyglyceryl-20 Heptacaprylate  
Polyglyceryl-20 Heptadecabehenate/Laurate  
Polyglyceryl-20 Hexacaprylate  
Polyglyceryl-20 Octadecabehenate/Laurate  
Polyglyceryl-20 Octaisnonanoate  
Pumpkin Seed Oil Polyglyceryl-4 Esters  
Pumpkin Seed Oil Polyglyceryl-4 Esters Succinate  
Rice Bran Oil Polyglyceryl-3 Esters  
Rosa Rubiginosa Seed Oil Polyglyceryl-6 Esters  
Safflower Seed Oil Polyglyceryl-6 Esters  
Schinziophyton Rautanenii Kernel Oil Polyglyceryl-6 Esters  
Sclerocarya Birrea Seed Oil Polyglyceryl-6 Esters  
Sclerocarya Birrea Seed Oil Polyglyceryl-10 Esters  
Sesame Oil Polyglyceryl-6 Esters  
Shea Butter Polyglyceryl-3 Esters  
Shea Butter Polyglyceryl-4 Esters  
Shea Butter Polyglyceryl-6 Esters  
Soybean Oil Polyglyceryl-6 Esters  
Sunflower Seed Oil Polyglyceryl-3 Esters  
Sunflower Seed Oil Polyglyceryl-4 Esters  
Sunflower Seed Oil Polyglyceryl-5 Esters  
Sunflower Seed Oil Polyglyceryl-6 Esters  
Sunflower Seed Oil Polyglyceryl-10 Esters  
Sweet Almond Oil Polyglyceryl-4 Esters  
Sweet Almond Oil Polyglyceryl-6 Esters  
Theobroma Grandiflorum Seed Butter Polyglyceryl-6 Esters  
Trichilia Emetica Seed Oil Polyglyceryl-6 Esters  
Triisostearoyl Polyglyceryl-3 Dimer Dilinoleate  
Watermelon Seed Oil Polyglyceryl-6 Esters  
Watermelon Seed Oil Polyglyceryl-10 Esters  
Ximenia Americana Seed Oil Polyglyceryl-6 Esters

---

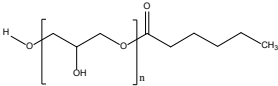
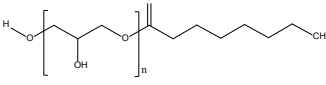
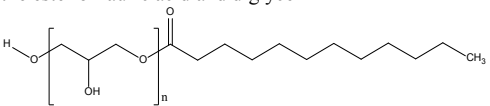
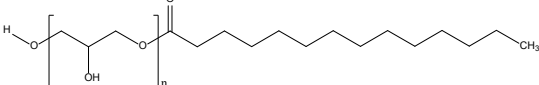
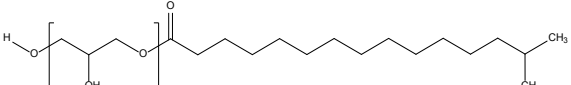
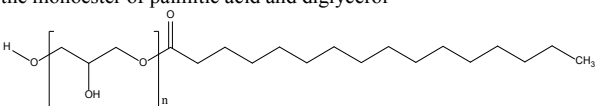
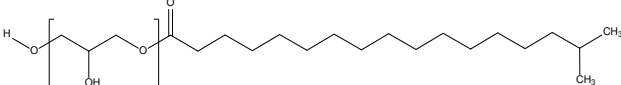
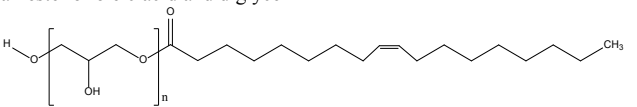
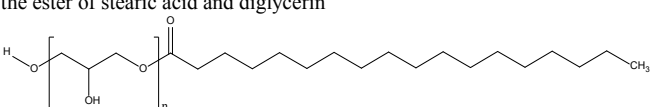
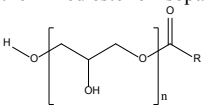
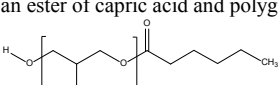
**Table 2. Polyglyceryl Fatty Acid Esters – arranged by polyglyceryl chain length**

Polyglyceryl Monoesters		
<u><i>Polyglyceryl-2 discrete esters</i></u>	<u><i>Polyglyceryl-5 discrete esters</i></u>	<u><i>Polyglyceryl-6 mixed esters (con't)</i></u>
Polyglyceryl-2 Caprate	Polyglyceryl-5 Caprate	Soybean Oil Polyglyceryl-6 Esters
Polyglyceryl-2 Caprylate	Polyglyceryl-5 Laurate	Sunflower Seed Oil Polyglyceryl-6 Esters
Polyglyceryl-2 Laurate	Polyglyceryl-5 Myristate	Sweet Almond Oil Polyglyceryl-6 Esters
Polyglyceryl-2 Myristate	Polyglyceryl-5 Isostearate	Theobroma Grandiflorum Seed Butter
Polyglyceryl-2 Isopalmitate	Polyglyceryl-5 Oleate	Polyglyceryl-6 Esters
Polyglyceryl-2 Palmitate	Polyglyceryl-5 Stearate	Trichilia Emetica Seed Oil Polyglyceryl-6 Esters
Polyglyceryl-2 Isostearate	Polyglyceryl-5 Ricinoleate	Watermelon Seed Oil Polyglyceryl-6 Esters
Polyglyceryl-2 Oleate		Ximenia Americana Seed Oil Polyglyceryl-6 Esters
Polyglyceryl-2 Stearate		
<u><i>Polyglyceryl-2 mixed esters</i></u>	<u><i>Polyglyceryl-5 mixed esters</i></u>	<u><i>Polyglyceryl-8 discrete esters</i></u>
Polyglyceryl-2 Isopalmitate/Sebacate	Apricot Kernel Oil Polyglyceryl-5 Esters	Polyglyceryl-8 Oleate
	Palm Oil Polyglyceryl-5 Esters	Polyglyceryl-8 Stearate
	Sunflower Seed Oil Polyglyceryl-5 Esters	
<u><i>Polyglyceryl-3 discrete esters</i></u>	<u><i>Polyglyceryl-6 discrete esters</i></u>	<u><i>Polyglyceryl-8 mixed esters</i></u>
Polyglyceryl-3 Caprate	Polyglyceryl-6 Caprate	Polyglyceryl-8 C12-20 Acid Ester
Polyglyceryl-3 Caprylate	Polyglyceryl-6 Caprylate	
Polyglyceryl-3 Laurate	Polyglyceryl-6 Undecylenate	<u><i>Polyglyceryl-10 discrete esters</i></u>
Polyglyceryl-3 Myristate	Polyglyceryl-6 Laurate	Polyglyceryl-10 Caprate
Polyglyceryl-3 Palmitate	Polyglyceryl-6 Myristate	Polyglyceryl-10 Caprylate
Polyglyceryl-3 Isostearate	Polyglyceryl-6 Palmitate	Polyglyceryl-10 Undecylenate
Polyglyceryl-3 Oleate	Polyglyceryl-6 Isostearate	Polyglyceryl-10 Laurate
Polyglyceryl-3 Stearate	Polyglyceryl-6 Oleate	Polyglyceryl-10 Myristate
Polyglyceryl-3 Stearate SE	Polyglyceryl-6 Stearate	Polyglyceryl-10 Palmitate
Polyglyceryl-3 Ricinoleate	Polyglyceryl-6 Ricinoleate	Polyglyceryl-10 Isostearate
Polyglyceryl-3 Behenate	Polyglyceryl-6 Behenate	Polyglyceryl-10 Linoleate
		Polyglyceryl-10 Oleate
		Polyglyceryl-10 Stearate
<u><i>Polyglyceryl-3 mixed esters</i></u>	<u><i>Polyglyceryl-6 mixed esters</i></u>	<u><i>Polyglyceryl-10 mixed esters</i></u>
Apricot Kernel Oil Polyglyceryl-3 Esters	Adansonia Digitata Seed Oil Polyglyceryl-6 Esters	Almond Oil/Polyglyceryl-10 Esters
Candelilla/Jojoba/Rice Bran Polyglyceryl-3 Esters	Apricot Kernel Oil Polyglyceryl-6 Esters	Apricot Kernel Oil Polyglyceryl-10 Esters
Olive Oil Polyglyceryl-3 Esters	Argan Oil Polyglyceryl-6 Esters	Caprylic/Capric Glycerides Polyglyceryl-10 Esters
Palm Oil Polyglyceryl-3 Esters	Astrocaryum Vulgare Oil Polyglyceryl-6 Esters	Polyglyceryl-10 Apricot Kernelate
Polyglyceryl-3 Beeswax	Avocado Oil Polyglyceryl-6 Esters	Polyglyceryl-10 Behenate/Eicosadioate
Polyglyceryl-3 Cocoate	Babassu Oil Polyglyceryl-6 Esters	Polyglyceryl-10 Caprylate/Caprate
Polyglyceryl-3 Rice Branate	Bertholletia Excelsa Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-10 Cocoate
Polyglyceryl-3 Soyate/Shea Butterate	Borage Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-10 Eicosanedioate/Tetradecanedioate
Rice Bran Oil Polyglyceryl-3 Esters	Carapa Guaianensis Oil Polyglyceryl-6 Esters	Polyglyceryl-10 Hydroxystearate/Stearate/ Eicosadioate
Shea Butter Polyglyceryl-3 Esters	Castor Oil Polyglyceryl-6 Esters	Polyglyceryl-10 Palmate
Sunflower Seed Oil Polyglyceryl-3 Esters	Cocoa Butter Polyglyceryl-6 Esters	Sclerocarya Birrea Seed Oil Polyglyceryl-10 Esters
	Coconut Oil Polyglyceryl-6 Esters	Sunflower Seed Oil Polyglyceryl-10 Esters
<u><i>Polyglyceryl-4 discrete esters</i></u>	Coffee Seed Oil Polyglyceryl-6 Esters	Watermelon Seed Oil Polyglyceryl-10 Esters
Polyglyceryl-4 Caprate	Glycerol/Polyglyceryl-6 Isostearate/Behenate Esters	
Polyglyceryl-4 Caprylate	Hazelnut Seed Oil Polyglyceryl-6 Esters	
Polyglyceryl-4 Laurate	Macadamia Seed Oil Polyglyceryl-6 Esters	
Polyglyceryl-4 Isostearate	Mauritia Flexuosa Seed Oil Polyglyceryl-6 Esters	
Polyglyceryl-4 Oleate	Olive Oil Polyglyceryl-6 Esters	
Polyglyceryl-4 Stearate	Palm Oil Polyglyceryl-6 Esters	
	Parinari Curatellifolia Oil Polyglyceryl-6 Esters	
<u><i>Polyglyceryl-4 mixed esters</i></u>	Pinus Sibirica Seed Oil Polyglyceryl-6 Esters	
Apricot Kernel Oil Polyglyceryl-4 Esters	Polyglyceryl-6 Adansonia Digitata Seedate	
Babassu Oil Polyglyceryl-4 Esters	Polyglyceryl-6 Apricot Kernelate	
Borage Seed Oil Polyglyceryl-4 Esters	Polyglyceryl-6 Argan Kernelate	
Linseed Oil Polyglyceryl-4 Esters	Polyglyceryl-6 Caprylate/Caprate	
Olive Oil Polyglyceryl-4 Esters	Polyglyceryl-6 Citrullus Lanatus Seedate	
Palm Kernel Oil Polyglyceryl-4 Esters	Polyglyceryl-6 Palmitate/Succinate	
Palm Oil Polyglyceryl-4 Esters	Polyglyceryl-6 Schinziophyton Rautanenii Kernelate	
Polyglyceryl-4 Almond/Shea Butterate	Polyglyceryl-6 Sclerocarya Birrea Seedate	
Polyglyceryl-4 Caprylate/Caprate	Polyglyceryl-6 Trichilia Emetica Seedate	
Polyglyceryl-4 Cocoate	Polyglyceryl-6 Ximenia Americana Seedate	
Polyglyceryl-4 Hazelnutseedate	Rosa Rubiginosa Seed Oil Polyglyceryl-6 Esters	
Polyglyceryl-4 Isostearate/Laurate	Safflower Seed Oil Polyglyceryl-6 Esters	
Polyglyceryl-4 Laurate/Sebacate	Schinziophyton Rautanenii Kernel Oil	
Polyglyceryl-4 Laurate/Succinate	Polyglyceryl-6 Esters	
Polyglyceryl-4 Punicate	Sclerocarya Birrea Seed Oil Polyglyceryl-6 Esters	
Polyglyceryl-4 Sweet Almond/Shea Butter Polyglyceryl-4 Esters	Sesame Oil Polyglyceryl-6 Esters	
Sunflower Seed Oil Polyglyceryl-4 Esters	Shea Butter Polyglyceryl-6 Esters	
Sweet Almond Oil Polyglyceryl-4 Esters		

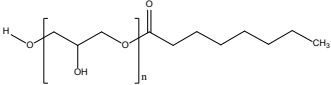
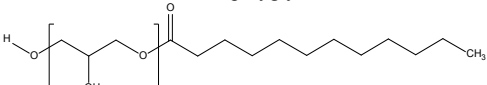
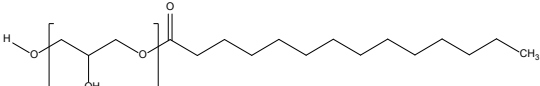
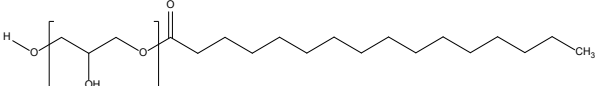
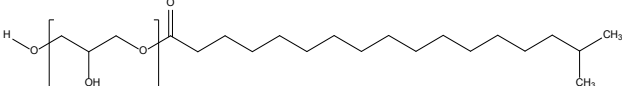
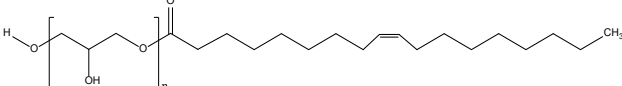
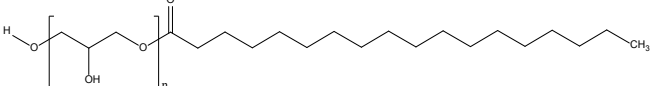
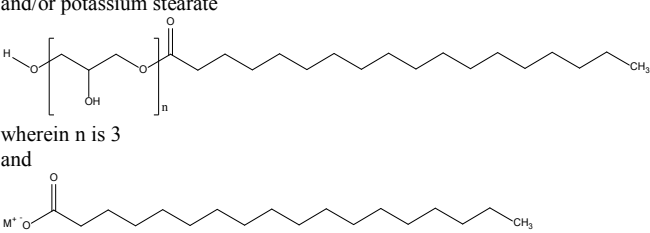
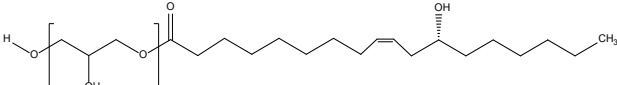
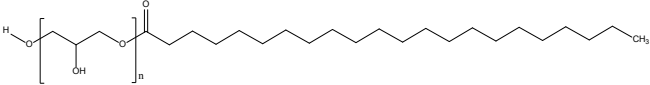
**Table 2. Polyglyceryl Fatty Acid Esters – arranged by polyglyceryl chain length**

Polyglyceryl Multi-esters (i.e., not mono-esters and not “polyesters”)		
<u>Polyglyceryl-2 discrete multi-esters</u>	<u>Polyglyceryl-6 discrete multi-esters</u>	<u>Polyglyceryl-10 discrete multi-esters (con't)</u>
Polyglyceryl-2 Sesquicaprylate	Polyglyceryl-6 Sesquicaprylate	Polyglyceryl-10 Pentaricinoleate
Polyglyceryl-2 Sesquiosostearate	Polyglyceryl-6 Dicaprate	Polyglyceryl-10 Hexaoleate
Polyglyceryl-2 Diisostearate	Polyglyceryl-6 Tricaprylate	Polyglyceryl-10 Heptaoleate
Polyglyceryl-2 Triisostearate	Polyglyceryl-6 Tetracaprylate	Polyglyceryl-10 Decaoleate
Polyglyceryl-2 Tetraisostearate	Polyglyceryl-6 Pentacaprylate	Polyglyceryl-10 Distearate
Polyglyceryl-2 Dioleate	Polyglyceryl-6 Heptacaprylate	Polyglyceryl-10 Tristearate
Polyglyceryl-2 Sesquioleate	Polyglyceryl-6 Octacaprylate	Polyglyceryl-10 Pentastearate
Polyglyceryl-2 Tetraoleate	Polyglyceryl-6 Dipalmitate	Polyglyceryl-10 Pentahydroxystearate
Polyglyceryl-2 Sesquisteate	Polyglyceryl-6 Sesquiosostearate	Polyglyceryl-10 Heptahydroxystearate
Polyglyceryl-2 Distearate	Polyglyceryl-6 Diisostearate	Polyglyceryl-10 Heptastearate
Polyglyceryl-2 Tetrastearate	Polyglyceryl-6 Dioleate	Polyglyceryl-10 Decahydroxystearate
	Polyglyceryl-6 Tetraoleate	Polyglyceryl-10 Decastearate
<u>Polyglyceryl-2 mixed multi-esters</u>	Polyglyceryl-6 Pentaoleate	Polyglyceryl-10 Dodecabehenate
Polyglyceryl-2 Tetrabehenate/ Macadamiate/Sebacate	Polyglyceryl-6 Hexaoleate	Polyglyceryl-10 Trierucate
	Polyglyceryl-6 Sesquisteate	Polyglyceryl-10 Hexaerucate
	Polyglyceryl-6 Distearate	
<u>Polyglyceryl-3 discrete multi-esters</u>	Polyglyceryl-6 Tristearate	<u>Polyglyceryl-10 mixed multi-esters</u>
Polyglyceryl-3 Dicaprate	Polyglyceryl-6 Pentastearate	Polyglyceryl-10 Decamacadamiate
Polyglyceryl-3 Diisostearate	Polyglyceryl-6 Hexastearate	Polyglyceryl-10 Dicoate
Polyglyceryl-3 Triisostearate	Polyglyceryl-6 Octastearate	Polyglyceryl-10 Didecanoate
Polyglyceryl-3 Dioleate	Polyglyceryl-6 Pentaricinoleate	Polyglyceryl-10 Dodeca-Caprylate/ Caprate
Polyglyceryl-3 Distearate	Polyglyceryl-6 Tetrabehenate	Polyglyceryl-10 Hepta(Behenate/Stearate)
Polyglyceryl-3 Di-Hydroxystearate		Polyglyceryl-10 Mono/Dioleate
Polyglyceryl-3 Pentaricinoleate	<u>Polyglyceryl-6 mixed multi-ester</u>	Polyglyceryl-10 Sesquisteate
	Macadamia Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-10 Tetradecanedioate
	Behenate	Polyglyceryl-10 Tricocoate
<u>Polyglyceryl-3 mixed multi-esters</u>	<u>Polyglyceryl-8 mixed multi-esters</u>	<u>Polyglyceryl-15 discrete multi-ester</u>
Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate	Polyglyceryl-8 Decabehenate/Caprate	Polyglyceryl-15 Diisostearate
Polyglyceryl-3 Dicitrate/Stearate	Polyglyceryl-8 Decaerucate/Decaisostearate/ Decaricinoleate	
Polyglyceryl-3 Dicoate		<u>Polyglyceryl-20 discrete multi-esters</u>
Polyglyceryl-3 Pentacaprylate/Caprate		Polyglyceryl-20 Hexacaprylate
Polyglyceryl-3 Pentaolive		Polyglyceryl-20 Heptacaprylate
Polyglyceryl-3 Triolive		Polyglyceryl-20 Octaiononanoate
Triisostearoyl Polyglyceryl-3 Dimer Dilinoleate	<u>Polyglyceryl-10 discrete multi-esters</u>	
	Polyglyceryl-10 Decaethylhexanoate	<u>Polyglyceryl-20 mixed multi-esters</u>
<u>Polyglyceryl-4 discrete multi-esters</u>	Polyglyceryl-10 Dodecacaprate	Polyglyceryl-20 Docosabehenate/Isostearate
Polyglyceryl-4 Dilaurate	Polyglyceryl-10 Pentacaprylate	Polyglyceryl-20 Docosabehenate/Laurate
Polyglyceryl-4 Pentaoleate	Polyglyceryl-10 Dodecacaprylate	Polyglyceryl-20 Docosabehenate/Oleate
Polyglyceryl-4 Distearate	Polyglyceryl-10 Tridecanoate	Polyglyceryl-20 Heptadecabehenate/Laurate
Polyglyceryl-4 Tristearate	Polyglyceryl-10 Dilaurate	Polyglyceryl-20 Octadecabehenate/Laurate
Polyglyceryl-4 Pentastearate	Polyglyceryl-10 Trilaurate	
	Polyglyceryl-10 Tetralaurate	
<u>Polyglyceryl-4 mixed multi-esters</u>	Polyglyceryl-10 Pentalaurate	
Polyglyceryl-4 Pentapalmitate/Stearate	Polyglyceryl-10 Dimyristate	
Pumpkin Seed Oil Polyglyceryl-4 Esters	Polyglyceryl-10 Dipalmitate	
Pumpkin Seed Oil Polyglyceryl-4 Esters Succinate	Polyglyceryl-10 Diisostearate	
	Polyglyceryl-10 Triisostearate	
<u>Polyglyceryl-5 discrete multi-esters</u>	Polyglyceryl-10 Pentaistearate	
Polyglyceryl-5 Dicaprylate	Polyglyceryl-10 Hexaistearate	
Polyglyceryl-5 Dilaurate	Polyglyceryl-10 Nonaisostearate	
Polyglyceryl-5 Trimyristate	Polyglyceryl-10 Decaisostearate	
Polyglyceryl-5 Pentamyristate	Polyglyceryl-10 Pentalinoleate	
Polyglyceryl-5 Triisostearate	Polyglyceryl-10 Decalinoleate	
Polyglyceryl-5 Dioleate	Polyglyceryl-10 Dioleate	
Polyglyceryl-5 Trioleate	Polyglyceryl-10 Trioleate	
Polyglyceryl-5 Tristearate	Polyglyceryl-10 Tetraoleate	
Polyglyceryl-5 Hexastearate	Polyglyceryl-10 Pentaoleate	
Polyglyceryl-5 Tribehenate		

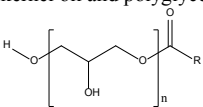
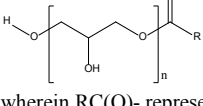
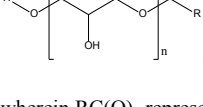
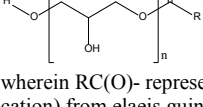
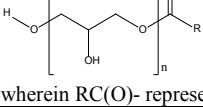
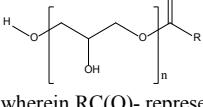
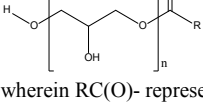
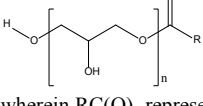
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
<b>Polyglyceryl Monoesters</b>		
<i>Polyglyceryl-2 discrete esters</i>		
Polyglyceryl-2 Caprate 156153-06-9	the ester of capric acid and diglycerin  wherein n is 2	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Caprylate	the ester of caprylic acid and diglycerin  wherein n is 2	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Laurate 96499-68-2	the ester of lauric acid and diglycerin  wherein n is 2	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Myristate	the monoester of myristic acid and diglycerol  wherein n is 2	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Isopalmitate	an ester of isopalmitic acid and diglycerin  wherein n is 2 (one example of an "iso")	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Palmitate	the monoester of palmitic acid and diglycerol  wherein n is 2	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Isostearate 73296-86-3 81752-33-2	the ester of isostearic acid and diglycerin  wherein n is 2 (one example of an "iso")	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Oleate 49553-76-6 9007-48-1 (generic)	an ester of oleic acid and diglycerin  wherein n is 2	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Stearate 12694-22-3 9009-32-9 (generic)	the ester of stearic acid and diglycerin  wherein n is 2	skin-conditioning agent - emollient; surfactant - emulsifying agent
<i>Polyglyceryl-2 mixed esters</i>		
Polyglyceryl-2 Isopalmitate/Sebacate	the mixed ester of isopalmitic acid, sebacic acid and diglycerin  wherein RC(O)- represents the residue of isopalmitic or sebacic acid, and n is 2	surfactant - emulsifying agent
<i>Polyglyceryl-3 discrete esters</i>		
Polyglyceryl-3 Caprate 133654-02-1 51033-30-8 74504-65-7	an ester of capric acid and polyglycerin-3  wherein n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent

**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

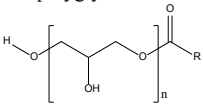
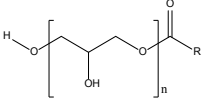
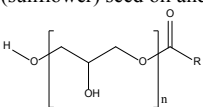
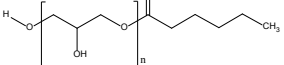
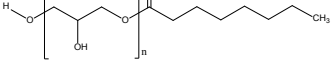
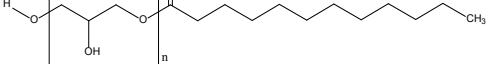
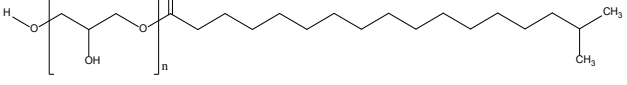
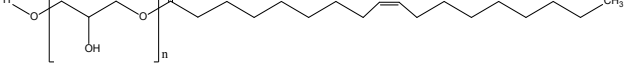
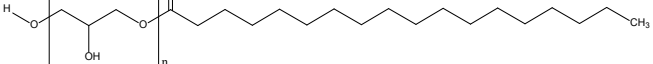
Ingredient CAS No.	Definition & Structure	Function(s)
Polyglyceryl-3 Caprylate 108777-93-1	the ester of caprylic acid and polyglycerin-3  wherein n is 3	deodorant agent; surfactants - emulsifying agent
Polyglyceryl-3 Laurate 51033-31-9	the ester of lauric acid and polyglycerin-3  wherein n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Myristate	the ester of myristic acid and polyglycerin-3  wherein n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Palmitate	an ester of palmitic acid and polyglycerin-3  wherein n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Isostearate 127512-63-4	the ester of isostearic acid and polyglycerin-3  wherein n is 3 (one example of an “iso”)	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Oleate 33940-98-6 9007-48-1 (generic)	an ester of oleic acid and polyglycerin-3  wherein n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Stearate 26855-43-6 27321-72-8 37349-34-1 (generic)	an ester of stearic acid and polyglycerin-3  wherein n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Stearate SE	a self-emulsifying grade of polyglyceryl-3 stearate that contains some sodium and/or potassium stearate  wherein n is 3 and  wherein M is sodium or potassium	surfactant - emulsifying agent
Polyglyceryl-3 Ricinoleate 29894-35-7 (generic)	an ester of ricinoleic acid and polyglycerin-3  wherein n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Behenate	the ester of behenic acid and polyglycerin-3  wherein n is 3	emulsion stabilizer; slip modifier; surface modifier

**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

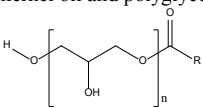
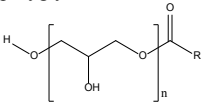
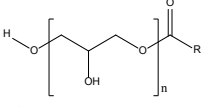
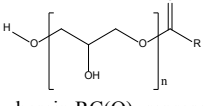
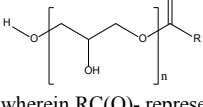
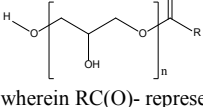
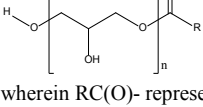
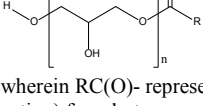
Ingredient CAS No.	Definition & Structure	Function(s)
<i>Polyglyceryl-3 mixed esters</i>		
Apricot Kernel Oil Polyglyceryl-3 Esters	<p>the product obtained by the transesterification of prunus armeniaca (apricot) kernel oil and polyglycerin-3</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from prunus armeniaca (apricot) kernel oil, and n is 3</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Candelilla/Jojoba/Rice Bran Polyglyceryl-3 Esters	<p>a product obtained by the transesterification of polyglycerin-3 and euphorbia cerifera (candelilla) wax, and simmondsia chinensis (jojoba) seed wax and oryza sativa (rice) bran wax</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from euphorbia cerifera (candelilla) wax, and simmondsia chinensis (jojoba) seed wax and oryza sativa (rice) bran wax, and n is 3</p>	emulsion stabilizer; surfactant - emulsifying agent
Olive Oil Polyglyceryl-3 Esters	<p>the product obtained by the transesterification of polyglycerin-3 and olea europaea (olive) fruit oil</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from olea europaea (olive) fruit oil, and n is 3</p>	surfactant – emulsifying agent
Palm Oil Polyglyceryl-3 Esters	<p>the product obtained by the transesterification of polyglycerin-3 and elaeis guineensis (palm) oil</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from elaeis guineensis (palm) oil, and n is 3</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Beeswax 136097-93-3	<p>an ester of beeswax fatty acids and polyglycerin-3</p>  <p>wherein RC(O)- represents the residue of beeswax fatty acids, and n is 3</p>	surfactant – emulsifying agent
Polyglyceryl-3 Cocoate	<p>the ester of coconut acid and polyglycerin-3</p>  <p>wherein RC(O)- represents the residue of coconut acid, and n is 3</p>	surfactant – emulsifying agent
Polyglyceryl-3 Rice Branate	<p>the monoester of polyglycerin-3 and rice bran acid</p>  <p>wherein RC(O)- represents the residue of rice bran acid, and n is 3</p>	surfactant – emulsifying agent
Polyglyceryl-3 Soyate/Shea Butterate	<p>an ester of a mixture of fatty acids derived from glycine soja (soybean) oil and butyrospermum parkii (shea) butter with polyglycerin-3</p>  <p>wherein RC(O)- represents the residue of the fatty acids obtained from glycine soja (soybean) oil and butyrospermum parkii (shea) butter, and n is 3</p>	surfactant – emulsifying agent



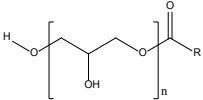
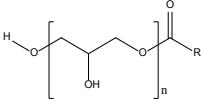
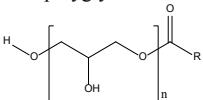
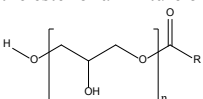
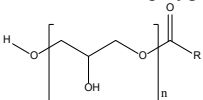
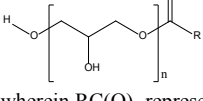
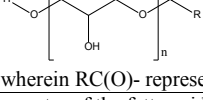
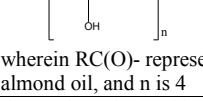
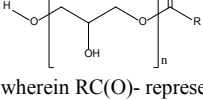
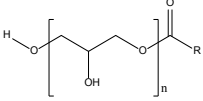
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Rice Bran Oil Polyglyceryl-3 Esters	the product obtained by the transesterification of oryza sativa (rice) bran oil and polyglycerin-3  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from oryza sativa (rice) bran oil, and n is 3	surfactants - emulsifying agent
Shea Butter Polyglyceryl-3 Esters	the product obtained by the transesterification of polyglycerin-3 and butyrospermum parkii (shea) butter  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from butyrospermum parkii (shea) butter, and n is 3	emulsion stabilizer; hair conditioning agent; skin-conditioning agent – miscellaneous; surfactant - emulsifying agent; viscosity increasing agent - aqueous
Sunflower Seed Oil Polyglyceryl-3 Esters	the product obtained by the transesterification of helianthus annuus (sunflower) seed oil and polyglycerin-3  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from helianthus annuus (sunflower) seed oil, and n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent
<i>Polyglyceryl-4 discrete esters</i>		
Polyglyceryl-4 Caprate 160391-93-5 74504-65-7	the ester of capric acid and polyglycerin-4  wherein n is 4	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-4 Caprylate	the monoester of caprylic acid and polyglycerin-4  wherein n is 4	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-4 Laurate 75798-42-4; 74504-64-6 (generic);	the ester of lauric acid and polyglycerin-4  wherein n is 4	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-4 Isostearate 63705-03-3 91824-88-3	an ester of isostearic acid and polyglycerin-4  wherein n is 4 (one example of an “iso”)	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-4 Oleate 71012-10-7 9007-48-1 (generic)	an ester of oleic acid and polyglycerin-4  wherein n is 4	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-4 Stearate 26855-44-7 37349-34-1 (generic) 68004-11-5	an ester of stearic acid and polyglycerin-4  wherein n is 4	surfactant - emulsifying agent

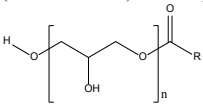
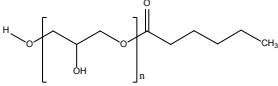
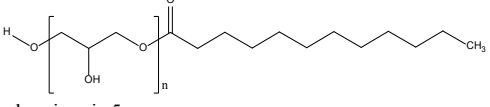
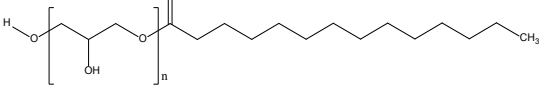
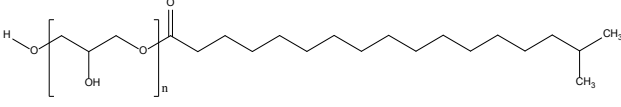
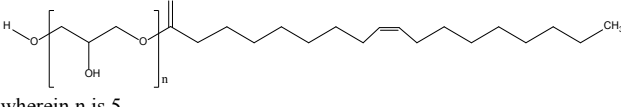
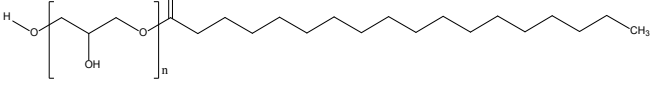
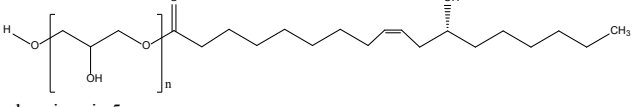
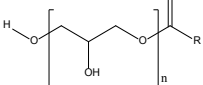
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

<b>Ingredient CAS No.</b>	<b>Definition &amp; Structure</b>	<b>Function(s)</b>
<i>Polyglyceryl-4 mixed esters</i>		
Apricot Kernel Oil Polyglyceryl-4 Esters	<p>the product obtained by the transesterification of prunus armeniaca (apricot) kernel oil and polyglycerin-4</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from prunus armeniaca (apricot) kernel oil, and n is 4</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Babassu Oil Polyglyceryl-4 Esters	<p>the product of the transesterification of orbignya oleifera seed oil and polyglycerin-4</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from orbignya oleifera seed oil, and n is 4</p>	surfactant - solubilizing agent
Borage Seed Oil Polyglyceryl-4 Esters	<p>the product obtained by the transesterification of borago officinalis seed oil and polyglycerin-4</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from borago officinalis seed oil, and n is 4</p>	opacifying agent; surfactant - emulsifying agent; surfactant - solubilizing agent
Linseed Oil Polyglyceryl-4 Esters	<p>the product obtained by the transesterification of linum usitatissimum (linseed) seed oil and polyglycerin-4</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from linum usitatissimum (linseed) seed oil, and n is 4</p>	opacifying agent; surfactant - emulsifying agent; surfactant - solubilizing agent
Olive Oil Polyglyceryl-4 Esters	<p>the product obtained by the transesterification of olea europaea (olive) fruit oil and polyglycerin-4</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from olea europaea (olive) fruit oil, and n is 4</p>	surfactant - solubilizing agent
Palm Kernel Oil Polyglyceryl-4 Esters	<p>is the product obtained by the transesterification of elaeis guineensis (palm) kernel oil and polyglycerin-4</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from elaeis guineensis (palm) kernel oil, and n is 4</p>	opacifying agent; surfactant - emulsifying agent; surfactant - solubilizing agent
Palm Oil Polyglyceryl-4 Esters	<p>the product obtained by the transesterification of polyglycerin-4 and elaeis guineensis (palm) oil</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from elaeis guineensis (palm) oil, and n is 4</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-4 Almond/Shea Butterate	<p>an ester of a mixture of fatty acids derived from almond oil and butyrospermum parkii (shea) butter with polyglycerin-4</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from butyrospermum parkii (shea) butter, and n is 4</p>	surfactant - emulsifying agent

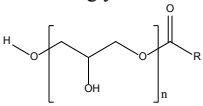
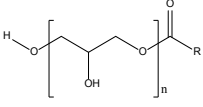
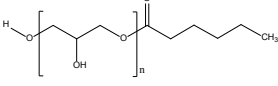
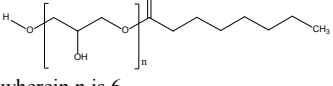
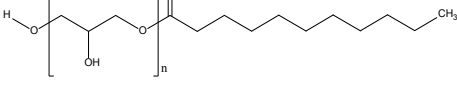
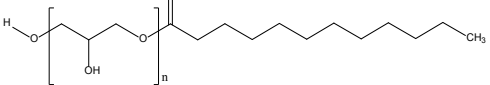
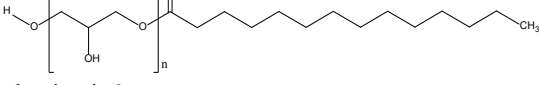
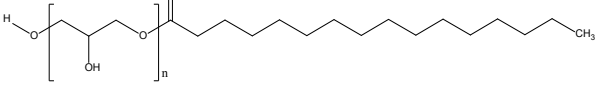
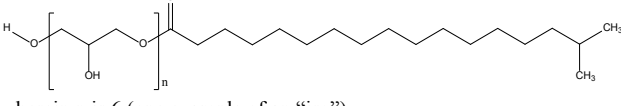
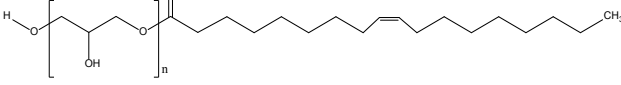
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Polyglyceryl-4 Caprylate/Caprate	the monoester of polyglycerin-4 and a mixture of caprylic and capric acids 	surfactant – hydro-trope; surfactant – solubilizing agent
Polyglyceryl-4 Cocoate	wherein RC(O)- represents the residue of capric or caprylic acid, and n is 4 an ester of coconut acid and polyglycerin-4 	surfactant - emulsifying agent
Polyglyceryl-4 Hazelnutseedate	wherein RC(O)- represents the residue of coconut acid, and n is 4 an ester of the fatty acids derived from corylus avellana (hazelnut) seed oil with polyglycerin-4 	surfactant - emulsifying agent
Polyglyceryl-4 Isostearate/Laurate	wherein RC(O)- represents the residue of the fatty acids derived from corylus avellana (hazelnut) seed oil, and n is 4 the ester of a mixture of isostearic and lauric acids with polyglycerin-4 	dispersing agent - nonsurfactant; emulsion stabilizer; surfactant - emulsifying agent; surfactant - foam booster
Polyglyceryl-4 Laurate/Sebacate	wherein RC(O)- represents the residue of isostearic or lauric acid, and n is 4 the monoester of polyglycerin-4 and a mixture of lauric and sebacic acids 	surfactant – hydrotrope; surfactant – solubilizing agent
Polyglyceryl-4 Laurate/Succinate	wherein RC(O)- represents the residue of lauric or sebacic acid, and n is 4 the monoester of polyglycerin-4 and a mixture of lauric and succinic acids 	surfactant - emulsifying agent
Polyglyceryl-4 Punicate	wherein RC(O)- represents the residue of lauric or succinic acid, and n is 4 the ester of polyglycerin-4 and punicic acid 	surfactant - emulsifying agent
Polyglyceryl-4 Sweet Almondate	wherein RC(O)- represents the residue of punicic acid, and n is 4 an ester of the fatty acids derived from sweet almond oil and polyglycerin-4 	skin-conditioning agent - misc; surfactant - emulsifying agent
Shea Butter Polyglyceryl-4 Esters	wherein RC(O)- represents the residue of the fatty acids obtained from sweet almond oil, and n is 4 the product obtained by the transesterification of butyrospermum parkii (shea) butter and polyglycerin-4 	emulsion stabilizer; skin-conditioning agent – emollient
Sunflower Seed Oil Polyglyceryl-4 Esters	wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from butyrospermum parkii (shea) butter, and n is 4 the product obtained by the transesterification of helianthus annuus (sunflower) seed oil and polyglycerin-4 	skin-conditioning agent - emollient; surfactant - emulsifying agent
	wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from helianthus annuus (sunflower) seed oil, and n is 4	

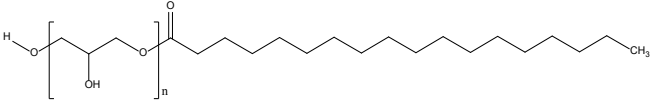
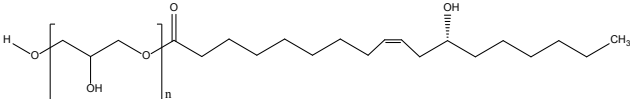
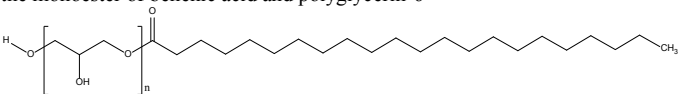
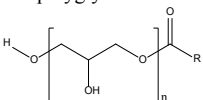
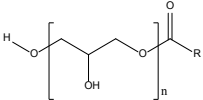
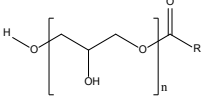
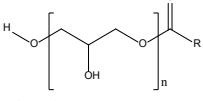
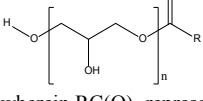
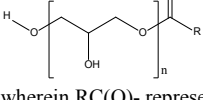
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Sweet Almond Oil Polyglyceryl-4 Esters 1072006-19-9 (generic)	the product obtained by the transesterification of prunus amygdalus dulcis (sweet almond) oil and polyglycerin-4  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from prunus amygdalus dulcis (sweet almond) oil, and n is 4	surfactants - solubilizing agent
<i>Polyglyceryl-5 discrete esters</i>		
Polyglyceryl-5 Caprate	the monoester of capric acid and polyglycerin-5  wherein n is 5	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-5 Laurate 128738-83-0; 74504-64-6 (generic)	the ester of lauric acid and a glycerin polymer containing an average of 5 glycerin units  wherein n is 5	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-5 Myristate	the monoester of myristic acid and a glycerin polymer containing 5 units of glycerin  wherein n is 5	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-5 Isostearate	the ester of isostearic acid and a glycerin polymer containing an average of 5 glycerin units  wherein n is 5 (one example of an “iso”)	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-5 Oleate 86529-98-8 9007-48-1 (generic)	the ester of oleic acid and a glycerin polymer containing an average of 5 glycerin units  wherein n is 5	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-5 Stearate 37349-34-1 (generic)	the monoester of stearic acid and a glycerin polymer containing 5 units of glycerin  wherein n is 5	surfactant - emulsifying agent
Polyglyceryl-5 Ricinoleate	is the product obtained by the reaction of ricinoleic acid with a glycerin polymer containing 5 glycerin units  wherein n is 5	surfactant - emulsifying agent
<i>Polyglyceryl-5 mixed esters</i>		
Apricot Kernel Oil Polyglyceryl-5 Esters	the product obtained by the transesterification of prunus armeniaca (apricot) kernel oil and polyglycerin-5  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from prunus armeniaca (apricot) kernel oil, and n is 5	skin-conditioning agent - emollient; surfactant - emulsifying agent

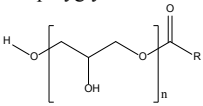
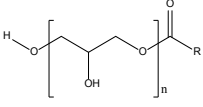
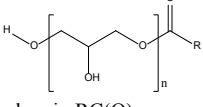
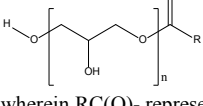
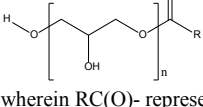
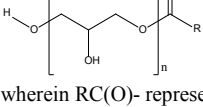
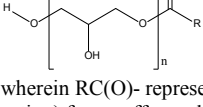
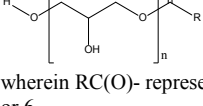
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Palm Oil Polyglyceryl-5 Esters	the product obtained by the transesterification of a glycerin polymer containing 5 units of glycerin and elaeis guineensis (palm) oil  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from elaeis guineensis (palm) oil, and n is 5	skin-conditioning agent - emollient; surfactant - emulsifying agent
Sunflower Seed Oil Polyglyceryl-5 Esters	the product obtained by the transesterification of helianthus annuus (sunflower) seed oil and a glycerin polymer containing 5 units of glycerin  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from helianthus annuus (sunflower) seed oil, and n is 5	skin-conditioning agent - emollient; surfactant - emulsifying agent
<i>Polyglyceryl-6 discrete esters</i>		
Polyglyceryl-6 Caprate	the monoester of capric acid and polyglycerin-6  wherein n is 6	surfactant - cleansing agent; surfactant - emulsifying agent
Polyglyceryl-6 Caprylate	the monoester of caprylic acid and polyglycerin-6  wherein n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Undecylenate	an ester of undecylenic acid and polyglycerin-6  wherein n is 6	surfactant - emulsifying agent
Polyglyceryl-6 Laurate 51033-38-6; 74504-64-6 (generic)	the ester of lauric acid and polyglycerin-6  wherein n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Myristate	the monoester of myristic acid and polyglycerin-6  wherein n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Palmitate 99734-31-3	the ester of palmitic acid and polyglycerin-6  wherein n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Isostearate 126928-07-2	the ester of isostearic acid and polyglycerin-6  wherein n is 6 (one example of an “iso”)	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Oleate 79665-92-2 9007-48-1 (generic)	the ester of oleic acid and polyglycerin-6  wherein n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent

**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

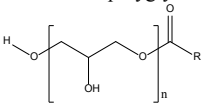
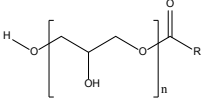
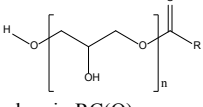
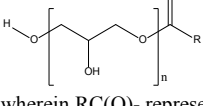
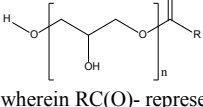
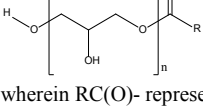
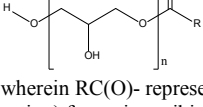
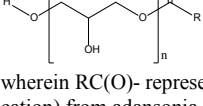
Ingredient CAS No.	Definition & Structure	Function(s)
Polyglyceryl-6 Stearate 95461-65-7	the ester of stearic acid and polyglycerin-6  wherein n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Ricinoleate 107615-51-0	the ester of polyglycerin-6 and ricinoleic acid  wherein n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Behenate	the monoester of behenic acid and polyglycerin-6  wherein n is 6	emulsion stabilizer; slip modifier; surface modifier
<i>Polyglyceryl-6 mixed esters</i>		
Adansonia Digitata Seed Oil Polyglyceryl-6 Esters	the product obtained by the transesterification of adansonia digitata seed oil and polyglycerin-6  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from adansonia digitata seed oil, and n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Apricot Kernel Oil Polyglyceryl-6 Esters	the product obtained by the transesterification of prunus armeniaca (apricot) kernel oil and polyglycerin-6  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from prunus armeniaca (apricot) kernel oil, and n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Argan Oil Polyglyceryl-6 Esters	the product obtained by the transesterification of argania spinosa kernel oil and polyglycerin-6  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from argania spinosa kernel oil, and n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Astrocaryum Vulgare Oil Polyglyceryl-6 Esters	the product obtained by the transesterification of astrocaryum vulgare kernel oil and polyglycerin-6  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from astrocaryum vulgare kernel oil, and n is 6	skin-conditioning agent - misc; surfactant - emulsifying agent
Avocado Oil Polyglyceryl-6 Esters	the product obtained by the transesterification of persea gratissima (avocado) oil and polyglycerin-6  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from persea gratissima (avocado) oil, and n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Babassu Oil Polyglyceryl-6 Esters	the product obtained by the transesterification of orbignya oleifera seed oil and polyglycerin-6  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from orbignya oleifera seed oil, and n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent

**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

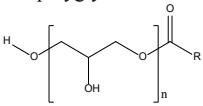
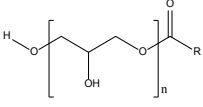
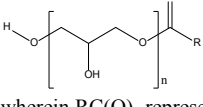
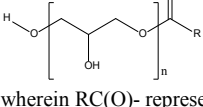
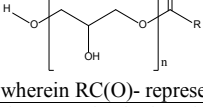
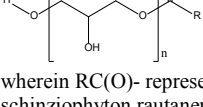
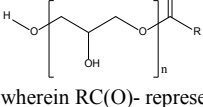
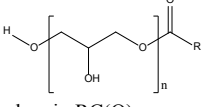
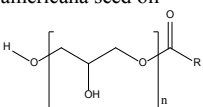
Ingredient CAS No.	Definition & Structure	Function(s)
Bertholletia Excelsa Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of bertholletia excelsa seed oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from bertholletia excelsa seed oil, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Borage Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of borago officinalis seed oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from borago officinalis seed oil, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Carapa Guaianensis Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of carapa guaianensis seed oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from carapa guaianensis seed oil, and n is 6</p>	skin-conditioning agent - emollient
Castor Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of ricinus communis (castor) seed oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from ricinus communis (castor) seed oil, and n is 6</p>	skin-conditioning agent - emollient; skin conditioning agent – misc; surfactant - emulsifying agent
Cocoa Butter Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of theobroma cacao (cocoa) seed butter and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from theobroma cacao (cocoa) seed butter, and n is 6</p>	skin-conditioning agent - emollient
Coconut Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of cocos nucifera (coconut) oil with polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from cocos nucifera (coconut) oil, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Coffee Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of polyglycerin-6 and coffea arabica (coffee) seed oil</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from coffea arabica (coffee) seed oil, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Glyceryl/Polyglyceryl-6 Isostearate/Behenate Esters	<p>the mixture of esters formed by the reaction of glycerin and polyglycerin-6 with isostearic acid and behenic acid</p>  <p>wherein RC(O)- represents the residue of isostearic or behenic acid, and n is 1 or 6</p>	skin-conditioning agent - emollient



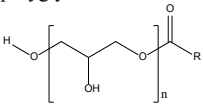
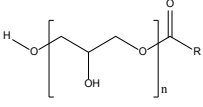
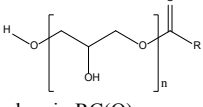
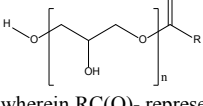
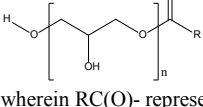
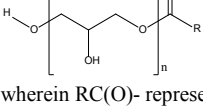
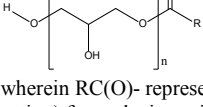
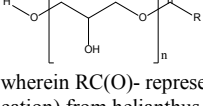
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Hazelnut Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of corylus avellana (hazelnut) seed oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from corylus avellana (hazelnut) seed oil, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Macadamia Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of macadamia ternifolia seed oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from macadamia ternifolia seed oil, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Mauritia Flexuosa Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of the oil obtained from the seeds of <i>Mauritia flexuosa</i> and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from the seeds of <i>Mauritia flexuosa</i>, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Olive Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of olea europaea (olive) fruit oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from olea europaea (olive) fruit oil, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Palm Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of polyglycerin-6 and elaeis guineensis (palm) oil</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from elaeis guineensis (palm) oil, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Parinari Curatellifolia Oil Polyglyceryl-6 Esters	<p>the product of the transesterification of the oil obtained from the seeds of <i>Parinari curatellifolia</i> and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from the seeds of <i>Parinari curatellifolia</i>, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Pinus Sibirica Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of pinus sibirica seed oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from pinus sibirica seed oil, and n is 6</p>	surfactant - emulsifying agent
Polyglyceryl-6 Adansonia Digitata Seedate	<p>the ester of the fatty acids obtained from adansonia digitata seed oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from adansonia digitata seed oil, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent

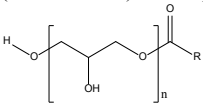
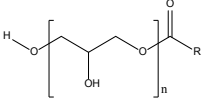
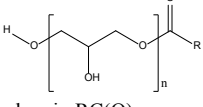
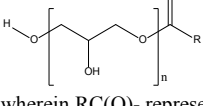
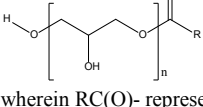
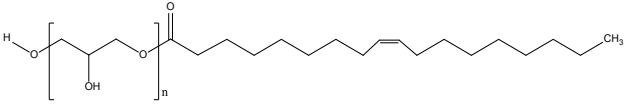
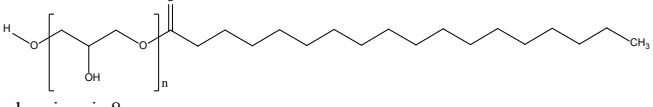
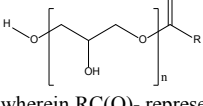
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Polyglyceryl-6 Apricot Kernelate	the ester of the fatty acids derived from prunus armeniaca (apricot) kernel oil and polyglycerin-6  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from prunus armeniaca (apricot) kernel oil, and n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Argan Kernelate	the ester of polyglycerin-6 and the fatty acids obtained from argania spinosa kernel oil  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from argania spinosa kernel oil, and n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Caprylate/Caprate	the monoester of polyglycerin-6 and a mixture of caprylic and capric acids  wherein RC(O)- represents the residue of capric or caprylic acid, and n is 6	surfactant - hydrotrope; surfactant - solubilizing agent
Polyglyceryl-6 Citrullus Lanatus Seedate	the ester of the fatty acids derived from citrullus lanatus (watermelon) seed oil and polyglycerin-6  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from citrullus lanatus (watermelon) seed oil, and n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Palmitate/Succinate	the monoester of polyglycerin-6 and a mixture of palmitic and succinic acids  wherein RC(O)- represents the residue of palmitic or succinic acid, and n is 6	surfactant - emulsifying agent
Polyglyceryl-6 Schinziophyton Rautanenii Kernelate	the ester of polyglycerin-6 and the fatty acids obtained from schinziophyton rautanenii kernel oil  wherein RC(O)- represents the residue of the fatty acids obtained from schinziophyton rautanenii kernel oil, and n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Sclerocarya Birrea Seedate	the ester of polyglycerin-6 and the fatty acids obtained sclerocarya birrea seed oil  wherein RC(O)- represents the residue of the fatty acids obtained from sclerocarya birrea seed oil, and n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Trichilia Emetica Seedate	the ester of polyglycerin-6 and the fatty acids obtained from trichilia emetica seed butter  wherein RC(O)- represents the residue of the fatty acids obtained from trichilia emetica seed butter, and n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Ximenia Americana Seedate	the ester of polyglycerin-6 and the fatty acids obtained from ximenia americana seed oil  wherein RC(O)- represents the residue of the fatty acids obtained from ximenia americana seed oil, and n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent

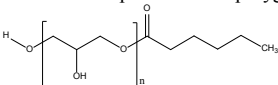
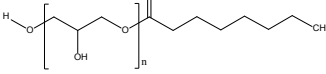
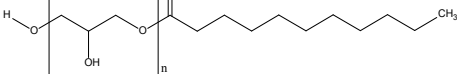
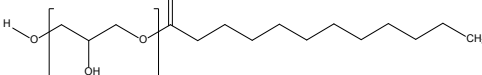
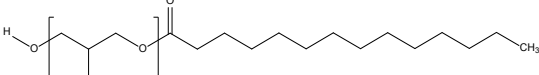
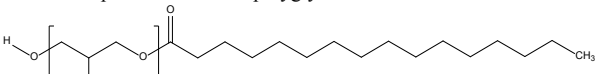
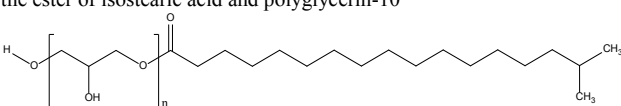
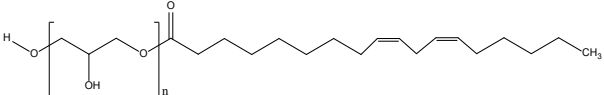
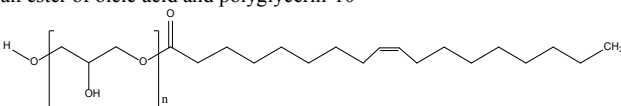
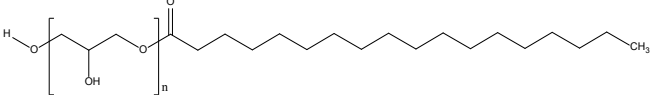
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Rosa Rubiginosa Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of rosa rubiginosa seed oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from rosa rubiginosa seed oil, and n is 6</p>	<p>skin-conditioning agent - emollient; skin-conditioning agent - miscellaneous; surfactant - emulsifying agent</p>
Safflower Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of carthamus tinctorius (safflower) seed oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from carthamus tinctorius (safflower) seed oil, and n is 6</p>	<p>skin-conditioning agent - emollient; surfactant - emulsifying agent</p>
Schinziophyton Rautanenii Kernel Oil Polyglyceryl-6 Esters	<p>the product formed by the transesterification of schinziophyton rautanenii kernel oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from schinziophyton rautanenii kernel oil, and n is 6</p>	<p>skin-conditioning agent - emollient; surfactant - emulsifying agent</p>
Sclerocarya Birrea Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of sclerocarya birrea seed oil with polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from sclerocarya birrea seed oil, and n is 6</p>	<p>skin-conditioning agent - emollient; surfactant - emulsifying agent</p>
Sesame Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of sesamum indicum (sesame) oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from sesamum indicum (sesame) oil, and n is 6</p>	<p>skin-conditioning agent - emollient; surfactant - emulsifying agent</p>
Shea Butter Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of butyrospermum parkii (shea) butter and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from butyrospermum parkii (shea) butter, and n is 6</p>	<p>skin-conditioning agent - emollient; surfactant - emulsifying agent</p>
Soybean Oil Polyglyceryl-6 Esters	<p>the product of the transesterification of glycine soja (soybean) oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from glycine soja (soybean) oil, and n is 6</p>	<p>skin-conditioning agent - emollient; surfactant - emulsifying agent</p>
Sunflower Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of helianthus annuus (sunflower) seed oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from helianthus annuus (sunflower) seed oil, and n is 6</p>	<p>skin-conditioning agent - emollient; surfactant - emulsifying agent</p>

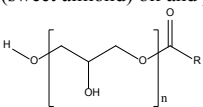
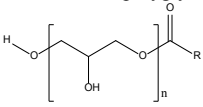
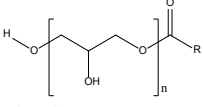
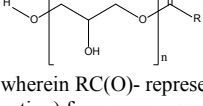
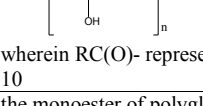
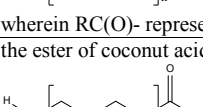
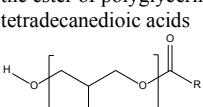
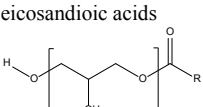

**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Sweet Almond Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of prunus amygdalus dulcis (sweet almond) oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from prunus amygdalus dulcis (sweet almond) oil, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Theobroma Grandiflorum Seed Butter Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of theobroma grandiflorum seed butter and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from theobroma grandiflorum seed butter, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Trichilia Emetica Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of trichilia emetica seed butter and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from trichilia emetica seed butter, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Watermelon Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of citrullus lanatus (watermelon) seed oil with polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from citrullus lanatus (watermelon) seed oil, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Ximenia Americana Seed Oil Polyglyceryl-6 Esters	<p>the product obtained by the transesterification of ximenia americana seed oil and polyglycerin-6</p>  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from ximenia americana seed oil, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
<i>Polyglyceryl-8 discrete esters</i>		
Polyglyceryl-8 Oleate 75719-56-1 9007-48-1 (generic)	<p>an ester of oleic acid and a glycerin polymer containing an average of 8 glycerin units</p>  <p>wherein n is 8</p>	skin-conditioning agent – misc.; surfactant - emulsifying agent
Polyglyceryl-8 Stearate 37349-34-1 (generic) 75719-57-2	<p>an ester of stearic acid and a glycerin polymer containing an average of 8 glycerin units</p>  <p>wherein n is 8</p>	surfactant - emulsifying agent
<i>Polyglyceryl-8 mixed esters</i>		
Polyglyceryl-8 C12-20 Acid Ester	<p>the ester of a glycerin polymer containing 8 units of glycerin and a synthetic mixture of saturated acids containing 12 to 20 carbons in the alkyl chain</p>  <p>wherein RC(O)- represents the residue of a fatty acid containing 12 to 20 carbons in the alkyl chain, and n is 8</p>	surfactant - emulsifying agent

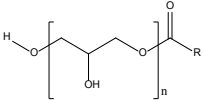
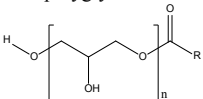
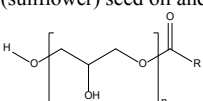
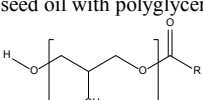
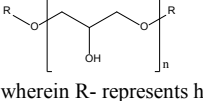
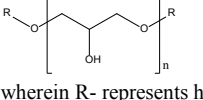
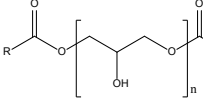
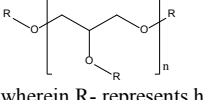
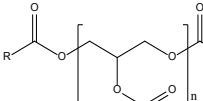
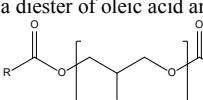
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
<i>Polyglyceryl-10 discrete esters</i> Polyglyceryl-10 Caprate	the ester of capric acid and polyglycerin-10  wherein n is 10	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Caprylate 51033-41-1	the monoester of caprylic acid and polyglycerin-10  wherein n is 10	surfactant - emulsifying agent
Polyglyceryl-10 Undecylenate	an ester of Undecylenic Acid and polyglycerin-10  wherein n is 10	surfactant - emulsifying agent
Polyglyceryl-10 Laurate 34406-66-1 74504-64-6 (generic)	an ester of lauric acid and polyglycerin-10  wherein n is 10	skin-conditioning agent - misc; surfactant - emulsifying agent
Polyglyceryl-10 Myristate 87390-32-7	an ester of myristic acid and polyglycerin-10  wherein n is 10	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Palmitate 79777-31-4	the ester of palmitic acid and polyglycerin-10  wherein n is 10	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Isostearate 133738-23-5	the ester of isostearic acid and polyglycerin-10  wherein n is 10 (one example of an “iso”)	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Linoleate	the monoester of linoleic acid and polyglycerin-10  wherein n is 10	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Oleate 79665-93-3 9007-48-1 (generic)	an ester of oleic acid and polyglycerin-10  wherein n is 10	skin-conditioning agent - misc; surfactant - emulsifying agent
Polyglyceryl-10 Stearate 79777-30-3 9009-32-9 (generic)	an ester of stearic acid and polyglycerin-10  wherein n is 10	skin-conditioning agent - misc; surfactant - emulsifying agent

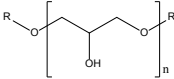
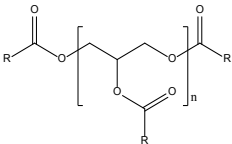
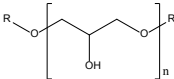
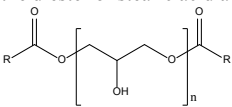
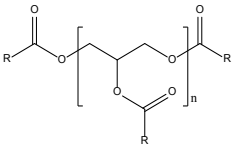
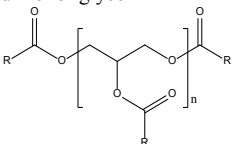
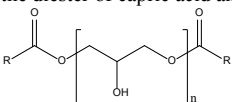
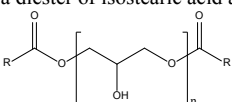
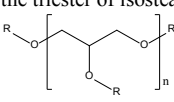
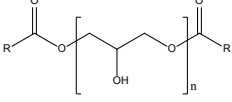
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
<i>Polyglyceryl-10 mixed esters</i> Almond Oil/Polyglyceryl-10 Esters	the product obtained by the transesterification of prunus amygdalus dulcis (sweet almond) oil and polyglycerin-10  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from prunus amygdalus dulcis (sweet almond) oil, and n is 10	surfactant - emulsifying agent
Apricot Kernel Oil Polyglyceryl-10 Esters	the product obtained by the transesterification of prunus armeniaca (apricot) kernel oil and polyglycerin-10  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from prunus armeniaca (apricot) kernel oil, and n is 10	skin-conditioning agent - emollient; surfactant – emulsifying agent
Caprylic/Capric Glycerides Polyglyceryl-10 Esters	the product obtained by the transesterification of caprylic/capric glycerides with polyglycerin-10  wherein RC(O)- represents the residue of caprylic or capric acid, and n is 10	skin-conditioning agent - emollient; surfactant – emulsifying agent; surfactant - solubilizing agent
Polyglyceryl-10 Apricot Kernelate	the ester of the fatty acids derived from prunus armeniaca (apricot) kernel oil and polyglycerin-10  wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from prunus armeniaca (apricot) kernel oil, and n is 10	skin-conditioning agent - emollient; skin-conditioning agent – miscellaneous; surfactant - emulsifying agent
Polyglyceryl-10 Behenate/Eicosadioate	the monoester of polyglycerin-10 and a blend of behenic and eicosadioic acids  wherein RC(O)- represents the residue of behenic or eicosadioic acid, and n is 10	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Caprylate/Caprate	the monoester of polyglycerin-10 and a blend of caprylic and capric acids  wherein RC(O)- represents the residue of capric or caprylic acid, and n is 10	emulsion stabilizer; solvent; surfactant – emulsifying agent
Polyglyceryl-10 Cocoate	the ester of coconut acid and polyglycerin-10  wherein RC(O)- represents the residue of coconut acid, and n is 10	surfactant-cleansing agent; surfactant-emulsifying agent
Polyglyceryl-10 Eicosanedioate/Tetradcanedioate	the ester of polyglycerin-10 with a mixture of eicosanedioic and tetradcanedioic acids  wherein RC(O)- represents the residue of eicosanedioic or tetradcanedioic acid, and n is 10	hair conditioning agent; skin conditioning agent - occlusive
Polyglyceryl-10 Hydroxystearate/Stearate/Eicosadioate	the monoester of polyglycerin-10 with a blend of hydroxystearic, stearic and eicosandioic acids  wherein RC(O)- represents the residue of hydroxystearic, stearic and eicosandioic acids, and n is 10	skin-conditioning agent - emollient

**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Polyglyceryl-10 Palmate	the ester of palm acid and polyglycerin-10 	skin-conditioning agent - misc; surfactant - emulsifying agent
Sclerocarya Birrea Seed Oil Polyglyceryl-10 Esters	wherein RC(O)- represents the residue of palm acid, and n is 10 the product obtained by the transesterification of sclerocarya birrea seed oil with polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Sunflower Seed Oil Polyglyceryl-10 Esters	wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from sclerocarya birrea seed oil, and n is 10 the product obtained by the transesterification of helianthus annuus (sunflower) seed oil and polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Watermelon Seed Oil Polyglyceryl-10 Esters	wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from helianthus annuus (sunflower) seed oil, and n is 10 the product obtained by the transesterification of citrullus lanatus (watermelon) seed oil with polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
<b>Polyglyceryl Multi-esters (i.e., not mono-esters and not “polyesters”)</b>		
<i>Polyglyceryl-2 discrete multi-esters</i>		
Polyglyceryl-2 Sesquicaprylate	a mixture of mono- and diesters of caprylic acid and diglycerin 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Sesquiisostearate 170211-20-8	wherein R- represents hydrogen or the residue of caprylic acid, and n is 2 a mixture of mono and diesters of isostearic acid and diglycerin 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Diisostearate 63705-03-3 (generic) 67938-21-0	wherein R- represents hydrogen or the residue of isostearic acid, and n is 2 the diester of isostearic acid and diglycerin 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Triisostearate 120486-24-0	wherein RC(O)- represents the residue of isostearic acid, and n is 2 the triester of isostearic acid and diglycerin 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Tetraisostearate 121440-30-0	wherein R- represents hydrogen or the residue of isostearic acid, and n is 2 the tetraester of isostearic acid and a dimer of glycerin 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Dioleate 60219-68-3 67965-56-4	wherein RC(O)- represents the residue of isostearic acid, and n is 2 a diester of oleic acid and diglycerin 	skin-conditioning agent - emollient; surfactant - emulsifying agent
	wherein RC(O)- represents the residue of oleic acid, and n is 2	

**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Polyglyceryl-2 Sesquioleate	a mixture of mono and diesters of oleic acid and diglycerin 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Tetraoleate	wherein R- represents hydrogen or the residue of oleic acid, and n is 2 the tetraester of oleic acid and diglycerin 	skin-conditioning agent - misc; surfactant - emulsifying agent
Polyglyceryl-2 Sesquistearate 9009-32-9 (generic)	wherein RC(O)- represents the residue of oleic acid, and n is 2 a mixture of mono- and diesters of stearic acid and diglycerin 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-2 Distearate 61725-93-7 9009-32-9 (generic)	wherein R- represents hydrogen or the residue of stearate acid, and n is 2 the diester of stearic acid and diglycerin 	surfactant - emulsifying agent
Polyglyceryl-2 Tetrastearate 72347-89-8 9009-32-9 (generic)	wherein RC(O)- represents the residue of stearic acid, and n is 2 the tetraester of stearic acid and diglycerin 	skin-conditioning agent - emollient; surfactant - emulsifying agent
<i>Polyglyceryl-2 mixed multi-esters</i>		
Polyglyceryl-2 Tetrabeheate/ Macadamiate/Sebacate	wherein RC(O)- represents the residue of stearic acid, and n is 2 the tetraester of a mixture of behenic, sebacic and macadamia acids with a dimer of glycerin 	skin-conditioning agent - emollient
<i>Polyglyceryl-3 discrete multi-esters</i>		
Polyglyceryl-3 Dicaprate	the diester of capric acid and polyglycerin-3 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Diisostearate 63705-03-3 (generic) 66082-42-6	wherein RC(O)- represents the residue of capric acid, and n is 3 a diester of isostearic acid and polyglycerin-3 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Triisostearate 66082-43-7	wherein RC(O)- represents the residue of isostearic acid, and n is 3 the triester of isostearic acid and polyglycerin-3 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Dioleate 79665-94-4	wherein R- represents hydrogen or the residue of isostearic acid, and n is 3 a diester of oleic acid and polyglycerin-3 	skin-conditioning agent - emollient; surfactant - emulsifying agent
	wherein RC(O)- represents the residue of oleic acid, and n is 3	



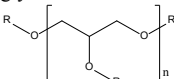
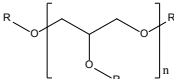
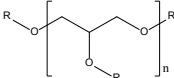
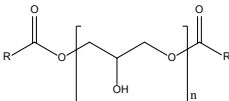
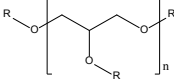
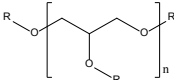
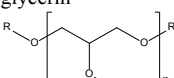
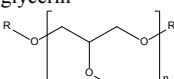
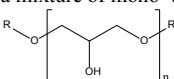
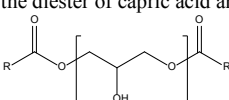
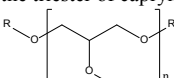
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Polyglyceryl-3 Distearate 94423-19-5 9009-32-9 (generic) 61725-93-7 (generic)	the diester of stearic acid and polyglycerin-3  wherein RC(O)- represents the residue of stearic acid, and n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Di-Hydroxystearate	the diester of hydroxystearic acid and polyglycerin-3  wherein RC(O)- represents the residue of hydroxystearic acid, and n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Pentaricinoleate	the pentaester of ricinoleic acid and polyglycerin-3  wherein RC(O)- represents the residue of ricinoleic acid, and n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent
<i>Polyglyceryl-3 mixed multi-esters</i>		
Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate	the diester of dilinoleic acid and Polyglyceryl-3 Diisostearate  wherein R- represents the residue of isostearic acid or dilinoleic acid, and n is 3	skin-conditioning agent - emollient
Polyglyceryl-3 Dicitrate/Stearate	the diester of polyglycerin-3 with a mixture of citric acid and stearic acid  wherein RC(O)- represents the residue of citric or stearic acid, and n is 3	surfactant - emulsifying agent
Polyglyceryl-3 Dicoate	the diester of coconut acid and polyglycerin-3  wherein RC(O)- represents the residue of coconut acid, and n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Pentacaprylate/Caprate	the pentaester of a mixture of caprylic acid and capric acid with polyglycerin-3  wherein R- represents hydrogen or the residue of capric or caprylic acid, and n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent; surfactant – solubilizing agent
Polyglyceryl-3 Pentaoliveate	is the pentaester of polyglycerin-3 and olive acid  wherein RC(O)- represents the residue of olive acid, and n is 3	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-3 Trioliveate	the triester of polyglycerin-3 and olive acid  wherein R- represents hydrogen or the residue of olive acid, and n is 3	surfactant - emulsifying agent
Triisostearoyl Polyglyceryl-3 Dimer Dilinoleate	the diester of dilinoleic acid and polyglyceryl-3 triisostearate  wherein R- represents the residue of isostearic acid or dilinoleic acid, and n is 3	skin-conditioning agent - emollient

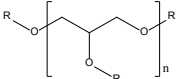
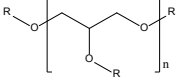
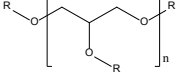
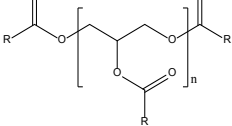
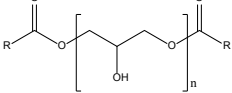
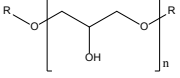
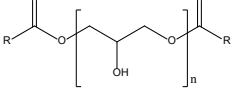
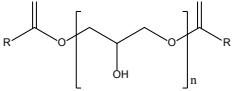
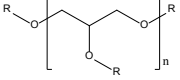
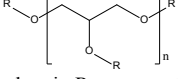
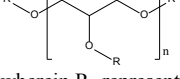
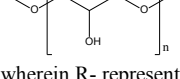
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
<i>Polyglyceryl-4 discrete multi-esters</i>		
Polyglyceryl-4 Dilaurate	the diester of lauric acid and polyglycerin-4  wherein RC(O)- represents the residue of lauric acid, and n is 4	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-4 Pentaoleate 103230-29-1	the pentaester of oleic acid and polyglycerin-4  wherein R- represents hydrogen or the residue of oleic acid, and n is 4	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-4 Distearate	a diester of polyglycerin-4 with stearic acid  wherein RC(O)- represents the residue of stearic acid, and n is 4	surfactant - emulsifying agent
Polyglyceryl-4 Tristearate 99734-29-9	the triester of stearic acid and polyglycerin-4  wherein R- represents hydrogen or the residue of stearic acid, and n is 4	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-4 Pentastearate 99570-00-0	the pentaester of stearic acid and polyglycerin-4  wherein R- represents hydrogen or the residue of stearic acid, and n is 4	skin-conditioning agent - emollient; surfactant - emulsifying agent
<i>Polyglyceryl-4 mixed multi-esters</i>		
Polyglyceryl-4 Pentapalmitate/Stearate	the pentaester of a mixture of palmitic acid and stearic acid with polyglycerin-4  wherein R- represents hydrogen or the residue of palmitic or stearic acid, and n is 4	surfactant - emulsifying agent
Pumpkin Seed Oil Polyglyceryl-4 Esters	the complex mixture of esters formed by the transesterification of cucurbita pepo (pumpkin) seed oil and polyglycerin-4  wherein R- represents hydrogen or the residue of the fatty acids derived from cucurbita pepo (pumpkin) seed oil (via transesterification), and n is 4	emulsion stabilizer; surfactant - emulsifying agent
Pumpkin Seed Oil Polyglyceryl-4 Esters Succinate	the complex mixture of esters formed by the transesterification of cucurbita pepo (pumpkin) seed oil and polyglycerin-4 reacted with succinic acid  wherein R- represents hydrogen or the residue of succinic acid or the fatty acids derived from cucurbita pepo (pumpkin) seed oil (via transesterification), and n is 4	emulsion stabilizer; surfactant - emulsifying agent
<i>Polyglyceryl-5 discrete multi-esters</i>		
Polyglyceryl-5 Dicaprylate 108777-93-1 (generic)	the diester of caprylic acid with a glycerin polymer containing 5 glycerin units  wherein RC(O)- represents the residue of caprylic acid, and n is 5	skin-conditioning agent - emollient; surfactant - cleansing agent; surfactant - emulsifying agent
Polyglyceryl-5 Dilaurate	the diester of lauric acid and a glycerin polymer containing 5 units of glycerin  wherein RC(O)- represents the residue of lauric acid, and n is 5	surfactant - emulsifying agent

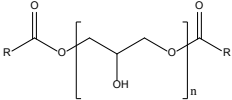
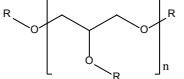
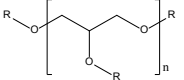
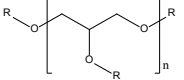
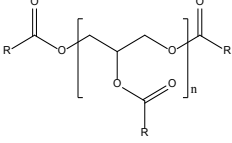
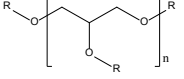
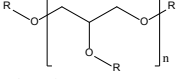
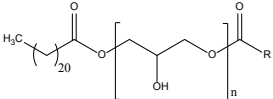
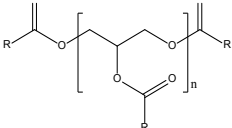
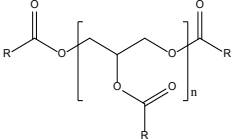
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

<b>Ingredient CAS No.</b>	<b>Definition &amp; Structure</b>	<b>Function(s)</b>
Polyglyceryl-5 Trimyristate	the triester of myristic acid and a glycerin polymer containing 5 units of glycerin  wherein R- represents hydrogen or the residue of myristic acid, and n is 5	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-5 Pentamyristate	the pentaester of myristic acid and a glycerin polymer containing 5 units of glycerin  wherein R- represents hydrogen or the residue of myristic acid, and n is 5	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-5 Triisostearate	the triester of isostearic acid and a glycerin polymer containing 5 units of glycerin  wherein R- represents hydrogen or the residue of isostearic acid, and n is 5	surfactant – cleansing agent; surfactant – dispersing agent; surfactant - emulsifying agent
Polyglyceryl-5 Dioleate	the diester of oleic acid and a glycerin polymer containing 5 units of glycerin  wherein RC(O)- represents the residue of oleic acid, and n is 5	surfactant - emulsifying agent
Polyglyceryl-5 Trioleate	the triester of oleic acid and a glycerin polymer containing 5 units of glycerin  wherein R- represents hydrogen or the residue of oleic acid, and n is 5	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-5 Tristearate 9009-32-9 (generic)	the triester of stearic acid and a glycerin polymer containing 5 units of glycerin  wherein R- represents hydrogen or the residue of stearic acid, and n is 5	surfactant – cleansing agent; surfactant – dispersing agent; surfactant - emulsifying agent
Polyglyceryl-5 Hexastearate	the hexaester of stearic acid and a glycerin polymer containing 5 units of glycerin  wherein R- represents hydrogen or the residue of stearic acid, and n is 5	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-5 Tribehenate	the triester of behenic acid and a glycerin polymer containing 5 units of glycerin  wherein R- represents hydrogen or the residue of behenic acid, and n is 5	skin-conditioning agent - emollient; surfactant - emulsifying agent
<i>Polyglyceryl-6 discrete multi-esters</i>		
Polyglyceryl-6 Sesquicaprylate 108777-93-1 (generic) 946492-22-4 (generic) 946492-23-5 (generic)	a mixture of mono- and diesters of caprylic acid and polyglycerin-6  wherein R- represents hydrogen or the residue of caprylic acid, and n is 6	skin-conditioning agent - emollient; surfactant – cleansing agent; surfactant - emulsifying agent
Polyglyceryl-6 Dicaprate	the diester of capric acid and polyglycerin-6  wherein RC(O)- represents the residue of capric acid, and n is 6	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Tricaprylate	the triester of caprylic acid and polyglycerin-6  wherein R- represents hydrogen or the residue of caprylic acid, and n is 6	surfactant – cleansing agent

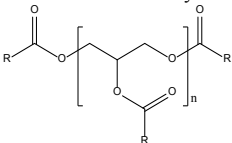
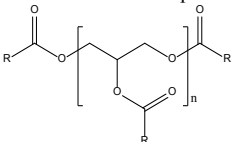
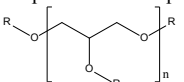
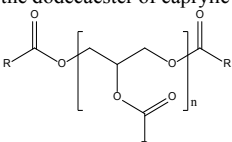
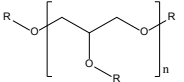
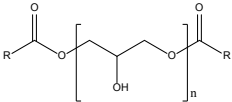
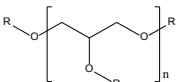
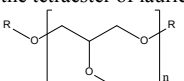
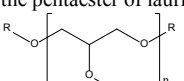
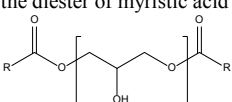
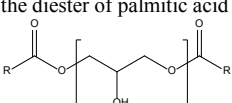
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

<b>Ingredient CAS No.</b>	<b>Definition &amp; Structure</b>	<b>Function(s)</b>
Polyglyceryl-6 Tetracaprylate	the tetraester of caprylic acid and polyglycerin-6 	surfactant – cleansing agent
Polyglyceryl-6 Pentacaprylate	wherein R- represents hydrogen or the residue of caprylic acid, and n is 6 the pentaester of caprylic acid and polyglycerin-6 	surfactant – cleansing agent
Polyglyceryl-6 Heptacaprylate	wherein R- represents hydrogen or the residue of caprylic acid, and n is 6 the heptaester of caprylic acid and polyglycerin-6 	surfactant - emulsifying agent
Polyglyceryl-6 Octacaprylate	wherein R- represents hydrogen or the residue of caprylic acid, and n is 6 the octaester of polyglycerin-6 and caprylic acid 	skin-conditioning agent - emollient
Polyglyceryl-6 Dipalmitate	wherein RC(O)- represents the residue of caprylic acid, and n is 6 the diester of palmitic acid and polyglycerin-6 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Sesquiisostearate	wherein RC(O)- represents the residue of palmitic acid, and n is 6 a mixture of mono- and diesters of isostearic acid and polyglycerin-6 	surfactant - emulsifying agent
Polyglyceryl-6 Diisostearate	wherein R- represents hydrogen or the residue of isostearic acid, and n is 6 the diester of isostearic acid and polyglycerin-6 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Dioleate 76009-37-5	wherein RC(O)- represents the residue of isostearic acid, and n is 6 a diester of oleic acid and polyglycerin-6 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Tetraoleate 128774-95-8	wherein RC(O)- represents the residue of oleic acid, and n is 6 the tetraester of Oleic Acid and polyglycerin-6 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Pentaoleate 104934-17-0	wherein R- represents hydrogen or the residue of oleic acid, and n is 6 the pentaester of oleic acid and polyglycerin-6 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Hexaoleate 95482-05-6	wherein R- represents hydrogen or the residue of oleic acid, and n is 6 a hexaester of oleic acid and polyglycerin-6 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Sesquistearate 112939-69-2	wherein R- represents hydrogen or the residue of oleic acid, and n is 6 a mixture of mono- and diesters of stearic acid and polyglycerin-6 	surfactant - emulsifying agent
	wherein R- represents hydrogen or the residue of stearic acid, and n is 6	

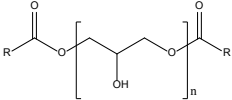
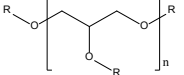
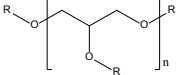
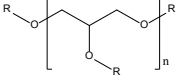
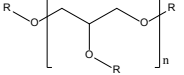
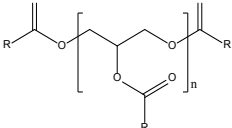
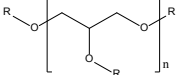
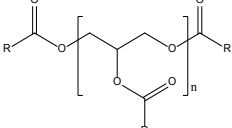
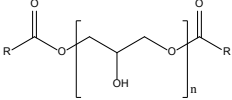
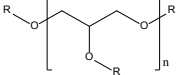
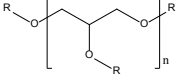
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Polyglyceryl-6 Distearate 34424-97-0 9009-32-9 (generic)	a diester of stearic acid and polyglycerin-6  <p>wherein RC(O)- represents the residue of stearic acid, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Tristearate 71185-87-0 9009-32-9 (generic)	the triester of stearic acid and polyglycerin-6  <p>wherein R- represents hydrogen or the residue of stearic acid, and n is 6</p>	surfactant - emulsifying agent
Polyglyceryl-6 Pentastearate 9009-32-9 (generic) 99734-30-2	the pentaester of stearic acid and polyglycerin-6  <p>wherein R- represents hydrogen or the residue of stearic acid, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Hexastearate	the hexaester of stearic acid and polyglycerin-6  <p>wherein R- represents hydrogen or the residue of stearic acid, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Octastearate	the octaester of stearic acid and polyglycerin-6  <p>wherein RC(O)- represents the residue of stearic acid, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Pentaricinoleate	the pentaester of ricinoleic acid and polyglycerin-6  <p>wherein R- represents hydrogen or the residue of ricinoleic acid, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-6 Tetrabehenate	the tetraester of behenic acid and polyglycerin-6  <p>wherein R- represents hydrogen or the residue of behenic acid, and n is 6</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
<i>Polyglyceryl-6 mixed multi-ester</i>		
Macadamia Seed Oil Polyglyceryl-6 Esters Behenate	the behenic acid ester of the product obtained by the transesterification of macadamia seed oil and polyglycerin-6  <p>wherein RC(O)- represents the residue of fatty acids derived (via transesterification) from macadamia ternifolia seed oil, and n is 6</p>	skin-conditioning agent - emollient
<i>Polyglyceryl-8 mixed multi-esters</i>		
Polyglyceryl-8 Decabehenate/Caprates	the decaester of a mixture of behenic acid and capric acid with a glycerin polymer containing 8 units of glycerin  <p>wherein RC(O)- represents the residue of capric or behenic acid, and n is 8</p>	viscosity increasing agent - nonaqueous
Polyglyceryl-8 Decaerucate/Decaisostearate/Decaricinoleate	the decaester of a glycerin polymer containing 8 units of glycerin with a mixture of erucic acid, isostearic acid and ricinoleic acid  <p>wherein RC(O)- represents the residue of erucic, isostearic, or ricinoleic acid, and n is 8</p>	skin-conditioning agent - emollient

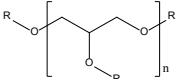
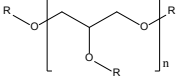
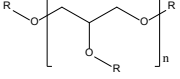
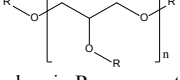
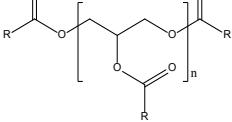
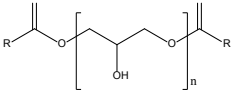
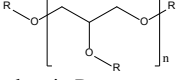
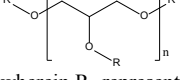
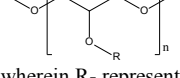
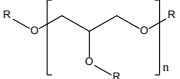
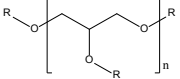
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
<i>Polyglyceryl-10 discrete multi-esters</i> Polyglyceryl-10 Decaethylhexanoate	the decaester of 2-ethylhexanoic acid and polyglycerin-10  wherein RC(O)- represents the residue of 2-ethylhexanoic acid, and n is 10	skin conditioning agent - humectant
Polyglyceryl-10 Dodecacaprate	the dodecaester of capric acid and polyglycerin-10  wherein RC(O)- represents the residue of capric acid, and n is 10	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Pentacaprylate	the pentaester of caprylic acid and polyglycerin-10  wherein R- represents hydrogen or the residue of caprylic acid, and n is 10	surfactant – cleansing agent; surfactant - emulsifying agent; surfactant – solubilizing agent
Polyglyceryl-10 Dodecaprylate	the dodecaester of caprylic acid and polyglycerin-10  wherein RC(O)- represents the residue of caprylic acid, and n is 10	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Tridecanoate 217782-56-4	the triester of decanoic acid and polyglycerin-10  wherein R- represents hydrogen or the residue of decanoic acid, and n is 10	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Dilaurate	the diester of lauric acid and polyglycerin-10  wherein RC(O)- represents the residue of lauric acid, and n is 10	surfactant – cleansing agent
Polyglyceryl-10 Trilaurate	the triester of lauric acid and polyglycerin-10  wherein R- represents hydrogen or the residue of lauric acid, and n is 10	surfactant – cleansing agent
Polyglyceryl-10 Tetralaurate	the tetraester of lauric acid and polyglycerin-10  wherein R- represents hydrogen or the residue of lauric acid, and n is 10	surfactant – cleansing agent
Polyglyceryl-10 Pentalaurate	the pentaester of lauric acid and polyglycerin-10  wherein R- represents hydrogen or the residue of lauric acid, and n is 10	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Dimyristate	the diester of myristic acid and polyglycerin-10  wherein RC(O)- represents the residue of myristic acid, and n is 10	surfactant - emulsifying agent
Polyglyceryl-10 Dipalmitate	the diester of palmitic acid and polyglycerin-10  wherein RC(O)- represents the residue of palmitic acid, and n is 10	skin-conditioning agent - emollient; surfactant - emulsifying agent

**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

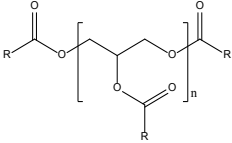
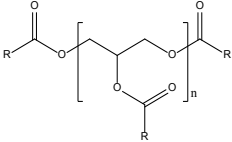
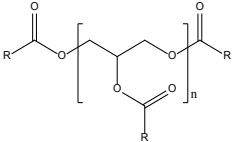
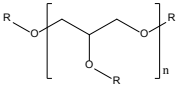
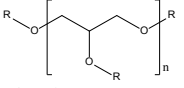
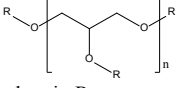
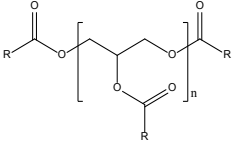
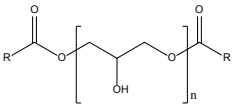
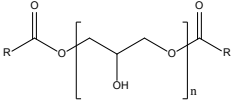
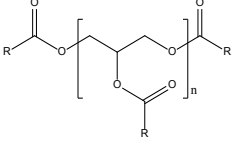
Ingredient CAS No.	Definition & Structure	Function(s)
Polyglyceryl-10 Diisostearate 102033-55-6 63705-03-3 (generic)	a diester of isostearic acid and polyglycerin-10  <p>wherein RC(O)- represents the residue of isostearic acid, and n is 10</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Triisostearate	the triester of polyglycerin-10 and isostearic acid  <p>wherein R- represents hydrogen or the residue of isostearic acid, and n is 10</p>	surfactant - emulsifying agent
Polyglyceryl-10 Pentaisostearate	the pentaester of isostearic acid and polyglycerin-10  <p>wherein R- represents hydrogen or the residue of isostearic acid, and n is 10</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Hexaisostearate	the hexaester of polyglycerin-10 and isostearic acid  <p>wherein R- represents hydrogen or the residue of isostearic acid, and n is 10</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Nonaisostearate	the nonaester of polyglycerin-10 and isostearic acid  <p>wherein R- represents hydrogen or the residue of isostearic acid, and n is 10</p>	skin-conditioning agent - emollient
Polyglyceryl-10 Decaisostearate	the ester of polyglycerin-10 and isostearic acid  <p>wherein RC(O)- represents the residue of isostearic acid, and n is 10</p>	skin-conditioning agent - emollient
Polyglyceryl-10 Pentalinoleate	the pentaester of linoleic acid and polyglycerin-10  <p>wherein R- represents hydrogen or the residue of linoleic acid, and n is 10</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Decalinoleate 68900-96-9	a decaester of linoleic acid and polyglycerin-10  <p>wherein RC(O)- represents the residue of linoleic acid, and n is 10</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Dioleate 33940-99-7	a diester of oleic acid and polyglycerin-10  <p>wherein RC(O)- represents the residue of oleic acid, and n is 10</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Trioleate 102051-00-3	the triester of oleic acid and polyglycerin-10  <p>wherein R- represents hydrogen or the residue of oleic acid, and n is 10</p>	surfactant - emulsifying agent
Polyglyceryl-10 Tetraoleate 34424-98-1	a tetraester of oleic acid and polyglycerin-10  <p>wherein R- represents hydrogen or the residue of oleic acid, and n is 10</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent

**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

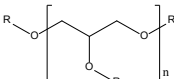
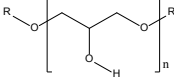
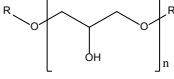
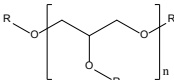
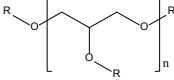
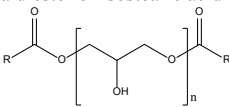
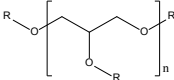
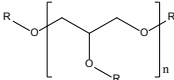
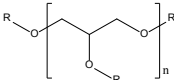
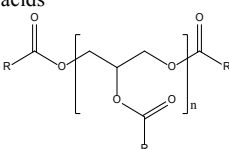
<b>Ingredient CAS No.</b>	<b>Definition &amp; Structure</b>	<b>Function(s)</b>
Polyglyceryl-10 Pentaoleate 86637-84-5	the pentaester of oleic acid and polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Pentaricinoleate	wherein R- represents hydrogen or the residue of oleic acid, and n is 10 the pentaester of ricinoleic acid and polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Hexaoleate 65573-03-7	wherein R- represents hydrogen or the residue of ricinoleic acid, and n is 10 the hexaester of oleic acid and polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Heptaoleate 103175-09-3	wherein R- represents hydrogen or the residue of oleic acid, and n is 10 a heptaester of oleic acid and polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Decaoleate 11094-60-3	wherein R- represents hydrogen or the residue of oleic acid, and n is 10 a decaester of oleic acid and polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Distearate 12764-60-2 9009-32-9 (generic)	wherein RC(O)- represents the residue of oleic acid, and n is 10 the diester of stearic acid and polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Tristearate 12709-64-7 9009-32-9 (generic)	wherein RC(O)- represents the residue of stearic acid, and n is 10 the triester of stearic acid and polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Pentastearate 9009-32-9 (generic) 95461-64-6	wherein R- represents hydrogen or the residue of stearic acid, and n is 10 a pentaester of stearic acid and polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Pentahydroxystearate	wherein R- represents hydrogen or the residue of stearic acid, and n is 10 the pentaester of hydroxystearic acid and polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Heptahydroxystearate	wherein R- represents hydrogen or the residue of hydroxystearic acid, and n is 10 a heptaester of hydroxystearic acid and polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Heptastearate 99126-54-2 9009-32-9 (generic)	wherein R- represents hydrogen or the residue of hydroxystearic acid, and n is 10 the heptaester of stearic acid and polyglycerin-10 	skin-conditioning agent - emollient; surfactant - emulsifying agent
	wherein R- represents hydrogen or the residue of stearic acid, and n is 10	



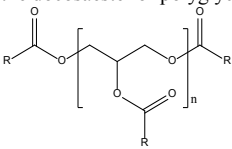
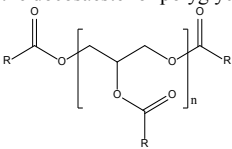
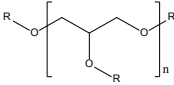
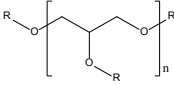
**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

<b>Ingredient CAS No.</b>	<b>Definition &amp; Structure</b>	<b>Function(s)</b>
Polyglyceryl-10 Decahydroxystearate	the decaester of hydroxystearic acid and polyglycerin-10  <p>wherein RC(O)- represents the residue of hydroxystearic acid, and n is 10</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Decastearate 39529-26-5	a decaester of stearic acid and polyglycerin-10  <p>wherein RC(O)- represents the residue of stearic acid, and n is 10</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Dodecabenate	the dodecaester of behenic acid and polyglycerin-10  <p>wherein RC(O)- represents the residue of behenic, and n is 10</p>	surfactant - emulsifying agent
Polyglyceryl-10 Trierucate	the triester of polyglycerin-10 and erucic acid  <p>wherein R- represents hydrogen or the residue of erucic acid, and n is 10</p>	surfactant – dispersing agent; surfactant - emulsifying agent
Polyglyceryl-10 Hexaerucate	the hexaester of polyglycerin-10 and erucic acid  <p>wherein R- represents hydrogen or the residue of erucic acid, and n is 10</p>	surfactant – dispersing agent; surfactant - emulsifying agent
Polyglyceryl-10 Nonaerucate 155808-79-0	the nonaester of erucic acid and polyglycerin-10  <p>wherein R- represents hydrogen or the residue of erucic acid, and n is 10</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
<i>Polyglyceryl-10 mixed multi-esters</i>		
Polyglyceryl-10 Decamacadamate	a decaester of polyglycerin-10 and the fatty acids derived from macadamia nut oil  <p>wherein RC(O)- represents the residue of the fatty acids derived from macadamia nut oil, and n is 10</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Dicocoate	the diester of coconut acid and polyglycerin-10  <p>wherein RC(O)- represents the residue of coconut acid, and n is 10</p>	surfactant – cleansing agent; surfactant - emulsifying agent
Polyglyceryl-10 Didecanoate 182015-59-4	the diester of decanoic acid and polyglycerin-10  <p>wherein RC(O)- represents the residue of decanoic acid, and n is 10</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Dodeca-Caprylate/ Caprate	the dodecaester of a mixture of caprylic and capric acids with polyglycerin-10  <p>wherein RC(O)- represents the residue of capric or caprylic acid, and n is 10</p>	skin-conditioning agent - occlusive

**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Polyglyceryl-10 Hepta(Behenate/Stearate)	the heptaester of polyglycerin-10 with a mixture of behenic acid and stearic acid  wherein R- represents hydrogen or the residue of behenic acid and stearic acid, and n is 10	surfactant - emulsifying agent
Polyglyceryl-10 Mono/Dioleate	a mixture of mono- and diesters of oleic acid and polyglycerin-10  wherein R- represents hydrogen or the residue of oleic acid, and n is 10	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-10 Sesquistearate	a mixture of mono- and diesters of stearic acid and polyglycerin-10  wherein R- represents hydrogen or the residue of stearate acid, and n is 10	surfactant - emulsifying agent
Polyglyceryl-10 Tetradecanedioate	the ester of tetradecanedioic acid and polyglycerin-10  wherein R- represents hydrogen or the residue of tetradecanedioic acid, and n is 10	hair conditioning agent; skin conditioning agent - humectant
Polyglyceryl-10 Tricocoate	the triester of coconut acid and polyglycerin-10  wherein R- represents hydrogen or the residue of coconut acid, and n is 10	surfactant – cleansing agent; surfactant - emulsifying agent
<i>Polyglyceryl-15 discrete multi-ester</i>		
Polyglyceryl-15 Diisostearate	a diester of isostearic acid and a glycerin polymer containing 15 glycerin units  wherein RC(O)- represents the residue of isostearic acid, and n is 15	hair conditioning agent; surfactant – cleansing agent; surfactant - emulsifying agent
<i>Polyglyceryl-20 discrete multi-esters</i>		
Polyglyceryl-20 Hexacaprylate	the hexaester of caprylic acid and polyglycerin-20  wherein R- represents hydrogen or the residue of caprylic acid, and n is 20	surfactant – cleansing agent; surfactant - emulsifying agent; surfactant – solubilizing agent
Polyglyceryl-20 Heptacaprylate	the heptaester of caprylic acid and polyglycerin-20  wherein R- represents hydrogen or the residue of caprylic acid, and n is 20	surfactant – cleansing agent; surfactant - emulsifying agent; surfactant – solubilizing agent
Polyglyceryl-20 Octaisiononanoate	the octaester of isononanoic acid and polyglycerin-20  wherein R- represents hydrogen or the residue of isononanoic acid, and n is 20	surfactant – cleansing agent; surfactant - emulsifying agent; surfactant – solubilizing agent
<i>Polyglyceryl-20 mixed multi-esters</i>		
Polyglyceryl-20 Docosabehenate/Isostearate	the docosaester of polyglycerin-20 with a mixture of behenic and isostearic acids  wherein RC(O)- represents the residue of behenic or isostearic acid, and n is 20	skin-conditioning agent - emollient; surfactant - emulsifying agent

**Table 3.** Definitions, idealized structures, and function <sup>1</sup> ( CIR Staff)

Ingredient CAS No.	Definition & Structure	Function(s)
Polyglyceryl-20 Docosabehenate/Laurate	<p>the docosaester of polyglycerin-20 with a mixture of behenic and lauric acids</p>  <p>wherein RC(O)- represents the residue of behenic or lauric acid, and n is 20</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-20 Docosabehenate/Oleate	<p>the docosaester of polyglycerin-20 with a mixture of behenic and oleic acids</p>  <p>wherein RC(O)- represents the residue of behenic or oleic acid, and n is 20</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-20 Heptadecabehenate/Laurate	<p>the heptadecaester of polyglycerin-20 with a mixture of behenic and lauric acids</p>  <p>wherein R- represents hydrogen or the residue of behenic or lauric acid, and n is 20</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent
Polyglyceryl-20 Octadecabehenate/Laurate	<p>the octadecaester of polyglycerin-20 and a mixture of behenic and lauric acids</p>  <p>wherein R- represents hydrogen or the residue of behenic or lauric acid, and n is 20</p>	skin-conditioning agent - emollient; surfactant - emulsifying agent

**Table 4. Previously Reviewed Components and Related Ingredients**

Component	Conclusion	Reference
Glycerin	safe in cosmetics in the present practices of use and concentration (was used in 15,654 formulations, 10,046 of which were leave-ons; the maximum use concentrations were 79.2% in leave-on products, 99.4% in rinse-off products, and 47.9% in products diluted for the bath)	69
Dipropylene Glycol	safe as used	70,71
Tripropylene Glycol	safe in the present practices of use and concentration when formulated to be non-irritating	72
Polypropylene Glycols (and PPG≥3)	safe in the present practices of use and concentration when formulated to be non-irritating	72
Monoglyceryl Monoesters	safe in the present practices of use and concentration	73
Glyceryl Alginate	safe in the present practices of use and concentration	73
Glyceryl Isostearate/Myristate	safe in the present practices of use and concentration	74
Glyceryl Myristate		
Citric Acid	safe in the present practices of use and concentration	75
Coconut Acid	safe for use as a cosmetic ingredient	76
Hydroxystearic Acid	safe as a cosmetic ingredient in the present practices of use	77
Isostearic Acid	safe as a cosmetic ingredient in the present practices of use	78
Lauric Acid	safe in the present practices of use and concentration	79
Myristic Acid	safe in the present practices of use and concentration	74
Oleic Acid	safe in the present practices of use and concentration	79
Olive Acid	safe in the present practices of use and concentration	80
Palm Acid	safe in the present practices of use and concentration	80
Palmitic Acid	safe in the present practices of use and concentration	79
Rice Bran Acid	safe in the present practices of use and concentration	80
Ricinoleic Acid	safe in the present practices of use and concentration	81
Sebacic Acid	safe in the present practices of use and concentration	82
Stearic Acid	safe in the present practices of use and concentration	79
Potassium Stearate		83,84
Sodium Stearate		83,84
Adansonia Digitata Seed Oil	safe in the present practices of use and concentration	80
Argania Spinosa Kernel Oil	safe in the present practices of use and concentration	80
Beeswax	safe in the present practices of use and concentration	85,86
Bertholletia Excelsa Seed Oil	safe in the present practices of use and concentration	80
Borago Officinalis Seed Oil	safe in the present practices of use and concentration	80
Butyrospermum Parkii (Shea) Butter	safe in the present practices of use and concentration	80
Caprylic/Capric/Coco Glycerides	safe for use as a cosmetic ingredient	76
Carthamus Tinctorius (Safflower) Seed Oil	safe in the present practices of use and concentration	80
Citrullus Lanatus (Watermelon) Seed Oil	safe in the present practices of use and concentration	80
Cocos Nucifera (Coconut) Oil	safe for use as a cosmetic ingredient	76
Cocoglycerides		
Hydrogenated Coco-Glycerides		
Corylus Avellana (Hazelnut) Seed Oil	safe in the present practices of use and concentration	80
Cucurbita Pepo (Pumpkin) Seed Oil	safe in the present practices of use and concentration	80
Elaeis Guineensis (Palm) Oil	safe in the present practices of use and concentration	80
Elaeis Guineensis (Palm) Kernel Oil		
Euphorbia Cerifera (Candelilla) Wax	safe in the present practices of use and concentration	85,86
Glycine Soja (Soybean) Oil	safe in the present practices of use and concentration	80
Hydrogenated Soybean Oil		
Helianthus Annuus (Sunflower) Seed Oil	safe in the present practices of use and concentration	80
Helianthus Annuus (Sunflower) Seed Wax		
Linum Usitatissimum (Linseed) Seed Oil	safe in the present practices of use and concentration	80
Macadamia Integrifolia Seed Oil	safe in the present practices of use and concentration	80
Macadamia Ternifolia Seed Oil		
Olea Europaea (Olive) Fruit Oil	safe in the present practices of use and concentration	80
Orbignya Oleifera Seed Oil		
Oryza Sativa (Rice) Bran Oil	safe in the present practices of use and concentration	87
Oryza Sativa (Rice) Bran Wax		
Persea Gratissima (Avocado) Oil	safe in the present practices of use and concentration	80
Prunus Amygdalus Dulcis (Sweet Almond) Oil	safe in the present practices of use and concentration	80
Prunus Armeniaca (Apricot) Kernel Oil	safe in the present practices of use and concentration	80
Ricinus Communis (Castor) Seed Oil	safe in the present practices of use and concentration	81

**Table 4. Previously Reviewed Components and Related Ingredients**

Component	Conclusion	Reference
Hydrogenated Castor Oil		
Schinziophyton Rautanenii Kernel Oil	safe in the present practices of use and concentration	80
Sclerocarya Birrea Seed Oil	safe in the present practices of use and concentration	80
Simmondsia Chinensis (Jojoba) Seed Wax	safe in the present practices of use and concentration	88
Sesamum Indicum (Sesame) Seed Oil	safe in the present practices of use and concentration	80
Theobroma Cacao (Cocoa) Seed Butter	safe in the present practices of use and concentration	80
Theobroma Grandiflorum Seed Butter	safe in the present practices of use and concentration	80

**Table 5. Average fatty acid composition of polyglyceryl fatty acid esters (%)**

Fatty Acids	Adansonia Digitata Seed Oil Polyglyceryl- 6 Esters <sup>89</sup>	Apricot Kernel Oil Polyglyceryl-6 Esters <sup>90</sup>	Apricot Kernel Oil Polyglyceryl-10 Esters <sup>91</sup>	Argan Oil Polyglyceryl-6 Esters <sup>92,92</sup>	Babassu Oil Polyglyceryl-6 Esters <sup>93</sup>	Bertholletia Excelsa Seed Oil Polyglyceryl- 6 Esters <sup>94</sup>	Caprylic/Capric Glycerides Poly- glyceryl-10 Esters <sup>95</sup>
Caproic (C6)							<2
Caprylic (C8)					2-8		50-65
Capric (C10)					1-8		30-50
Lauric (C12)*					35-55		<3
Myristic (C14)					10-30		<1
Myristoleic (C14:1)							
Palmitic (C16)	18-30	3.0-9.0	4.6-7.6	10-15	5-15	10-20	
Palmitoleic (C16:1)		<1.5					
Heptadecanoic (C17:0)							
Stearic (C18)	2-9	0.5-4.0	0.2-1.3	4-7	1-8	5-15	
Oleic (C18:1)	30-45	55.0-75.0	60-74	40-55	9-20	25-40	
Linoleic (C18:2)	20-40	20.0-35.0	20-34	25-40	1-7	30-55	
Linolenic (C18:3)	1-3			<0.5		<1	
Arachidic (C20)	< 2	<1.0		<1		<1	
Eicosenoic (C20:1)		<1.0		<1			
Behenic (C22)							
Erucic (C22:1)							
Lignoceric (C24)							
Others							

	Cocoa Butter Polyglyceryl-6 Esters <sup>96</sup>	Coconut oil Polyglyceryl-6 Esters <sup>97</sup>	Hazelnut Seed Oil Polyglyceryl-6 Esters <sup>98</sup>	Macadamia Seed Oil Polyglyceryl 6 Esters <sup>99</sup>	Olive Oil Polyglyceryl-6 Esters <sup>100</sup>	Polyglyceryl-10 Decaoleate <sup>32</sup>	Safflower Seed Oil Polyglyceryl-6 Esters <sup>101</sup>
Caproic (C6)		<1					
Caprylic (C8)		4-10					
Capric (C10)		4-11					
Lauric (C12)*		42-52				4.2	
Myristic (C14)		13-21				2.6	
Myristoleic (C14:1)							
Palmitic (C16)	20-35	6-12	4.5-9.	7-11	7.5-20	16.6	6-7
Palmitoleic (C16:1)	<1			16-30	<3.5		
Heptadecanoic (C17:0)							
Stearic (C18)	25-40	1-4	1-4	2-7	0.5-5	14.4	0.9-9.7
Oleic (C18:1)	25-40	3-12	66-86.2	50-67	55-85	5.3	10-20
Linoleic (C18:2)	2-5	0.5-4	8-10.4	1-5	3.5-20	55.8	68-83
Linolenic (C18:3)	<0.5		<0.6		<1.5		<0.2
Arachidic (C20)	0.5-2			1-4	<1		
Eicosenoic (C20:1)				1-3	<1		
Behenic (C22)							
Erucic (C22:1)							
Lignoceric (C24)							
Others						Total fatty acids are 83.1%	

**Table 5. Average fatty acid composition of polyglyceryl fatty acid esters (%)**

Fatty Acids	Schinziophyton Rautanenii Kernel Oil Polyglyceryl-6 Esters <sup>102</sup>	Sclerocarya Birrea Seed Oil Polyglyceryl- 6 Esters <sup>103</sup>	Sesame Oil Polyglyceryl-6 Esters <sup>104</sup>	Shea Butter Polyglyceryl-6 Esters <sup>105</sup>	Soybean Oil Polyglyceryl-6 Esters <sup>106</sup>	Sunflower Seed Oil Polyglyceryl-6 Esters (high oleic acid) <sup>107</sup>	Sunflower Seed Oil Polyglyceryl-10 Esters <sup>108</sup>
Caproic (C6)							
Caprylic (C8)							
Capric (C10)							
Lauric (C12)*							
Myristic (C14)		<0.2					
Myristoleic (C14:1)							
Palmitic (C16)	6-10	9-13	5-15	3-7	8-13	2-6	3-5.5
Palmitoleic (C16:1)		<0.2					
Heptadecanoic (C17:0)							
Stearic (C18)	4-8	4-8	2-8	35-47	2-7	1-5	2-5
Oleic (C18:1)	10-20	70-80	35-55	33-50	17-28.5	70-90	74-82
Linoleic (C18:2)	30-54	4-9	34-55	3-8	46-62	5-20	8-15.5
Linolenic (C18:3)	30-32	<0.7	<1.1	<2	4-10	<1	<0.2
Arachidic (C20)		<1	<1.2	<2.5		<1	
Eicosenoic (C20:1)				<0.5		<0.5	
Behenic (C22)						<1	
Erucic (C22:1)							
Lignoceric (C24)						<1	
Others							

	Sweet Almond Oil Polyglyceryl-6 Esters <sup>109</sup>	Trichilia Emetica Seed Oil Polyglyceryl-6 Esters <sup>110</sup>
Caproic (C6)		
Caprylic (C8)		
Capric (C10)		
Lauric (C12)*		
Myristic (C14)		
Myristoleic (C14:1)		
Palmitic (C16)	4-9	30-40
Palmitoleic (C16:1)		
Heptadecanoic (C17:0)	<1	
Stearic (C18)	<3	1.5-4
Oleic (C18:1)	62-86	45-55
Linoleic (C18:2)		8-13
Linolenic (C18:3)	20-30	<1.5
Arachidic (C20)	<1	
Eicosenoic (C20:1)		
Behenic (C22)		
Erucic (C22:1)		
Lignoceric (C24)		
Others		

**Table 6. Physical and Chemical Properties**

Property	Adansonia Digitata Seed Oil Polyglyceryl-6 Esters <sup>89</sup>	Apricot Kernel Oil Polyglyceryl-6 Esters <sup>90</sup>	Apricot Kernel Oil Polyglyceryl-10 Esters <sup>91</sup>	Argan Oil Polyglyceryl-6 Esters <sup>92,92</sup>	Babassu Oil Polyglyceryl-6 Esters <sup>93</sup>	Bertholletia Excelsa Seed Oil Polyglyceryl-6 Esters <sup>94</sup>	Borage Seed Oil Polyglyceryl-6 Esters <sup>111</sup>
physical characteristics	soft paste amber in color	amber liquid (20°C)	amber (physical state not specified)	amber liquid	soft paste with amber color	soft paste with amber color	oil
molecular wt							
solubility	water dispersible	water dispersible	water soluble	water dispersible	water dispersible	water dispersible	water dispersible
melting point (°C)							
density (g/ml)	<1	<1	>1		<1	<1	
specific gravity (g/ml)							
pH							
refractive index (20°C)	approx. 1.47	approx. 1.47	approx. 1.47	approx. 1.47	approx. 1.47	approx. 1.47	
saponification value	150 – 170	125-155		125-155	175-205	125-155	
acid value (mg KOH/g)	< 5	<5	<5	<5	<5	< 5	
hydroxyl value (mg KOH/g)							
peroxide value (meq of active oxygen/Kg)	<10	<10	<10	<10	<10	<10	
iodine value (gI <sub>2</sub> /100g)		75-90		75-90	10-25	75-90	
polarity	non-ionic, amphiphilic	non-ionic, amphiphilic	non-ionic, amphiphilic	non-ionic, amphiphilic	non-ionic, amphiphilic	non-ionic, amphiphilic	non-ionic, amphiphilic
HLB							
Property	Caprylic/Capric Glycerides Polyglyceryl-10 Esters <sup>95</sup>	Cocoa Butter Polyglyceryl-6 Esters <sup>96</sup>	Coconut Oil Polyglyceryl-6 Esters <sup>97</sup>	Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate	Hazelnut Seed Oil Polyglyceryl-6 Esters <sup>98</sup>	Macadamia Seed Oil Polyglyceryl-6 Esters <sup>99</sup>	Olive Oil Polyglyceryl-6 Esters <sup>100</sup>
physical characteristics	amber in color	beige solid	soft paste, with amber color	viscous liquid <sup>112</sup> yellow liquid <sup>113</sup> ~6000	amber	amber liquid	amber liquid
molecular wt							
solubility		water dispersible	water dispersible		water dispersible	water dispersible	water dispersible
melting point (°C)		40-50	40-50				
density (g/ml)	>1	<1	<1		<1	<1	<1
specific gravity (g/ml)							
pH							
refractive index (20°C)	approx. 1.47	approx. 1.47	approx. 1.47		approx. 1.47	~1.47	~1.47
saponification value		145-165	180-220	140-160 <sup>112</sup>		140-160	125-155
acid value (mg KOH/g)	<5	< 5	< 5	10.0 max <sup>112</sup>	<5	<5	<5
hydroxyl value (mg KOH/g)							
peroxide value (meq of active oxygen/Kg)	<10	<10	<10		<10	<10	<10
iodine value (gI <sub>2</sub> /100g)		20-35	3-10	10.0 max <sup>112</sup>			60-75
polarity	non-ionic, amphiphilic	non-ionic, amphiphilic	non-ionic, amphiphilic	~5 <sup>113</sup>	non-ionic, amphiphilic	non-ionic, amphiphilic	non-ionic, amphiphilic
HLB							



**Table 6. Physical and Chemical Properties**

	<b>Palm Kernel Oil Poly- glyceryl-4 Esters<sup>114</sup></b>	<b>Polyglyceryl-3 Beeswax<sup>115</sup></b>	<b>Polyglyceryl-2 Caprate<sup>116</sup></b>	<b>Polyglyceryl-4 Caprate</b>	<b>Polyglyceryl-3 Caprylate<sup>117</sup></b>	<b>Polyglyceryl-10 Caprylate/Caprate<sup>24,118</sup></b>	<b>Polyglyceryl-10 Decaisostearate<sup>119</sup></b>
physical characteristics		white to off-white		transparent, pale, yellow liquid with faint odor <sup>120</sup> colorless to yellow, clear to slightly turbid, viscous liquid <sup>121</sup>	high viscosity liquid	amber, viscous liquid	faint yellow liquid
molecular wt			320.42				
solubility	water- and oil- soluble			soluble in water, ethanol, 1,2-propanediol, esters oil; insoluble in paraffin oi, isopropyl myristate, vegetable oil <sup>121</sup>			insoluble in water
melting point (°C)		63-73					
density (g/ml)			1.083 g/cm <sup>3</sup>				
specific gravity (g/ml)							0.956 (25°C)
pH							
refractive index (20°C)			1.481				
saponification value		80-94		50-70 <sup>120</sup>		85-105	
acid value (mg KOH/g)		2 max		5 max <sup>120</sup>		7.0 max	
hydroxyl value (mg KOH/g)							
peroxide value (meq of active oxygen/Kg)						5.0 max	
iodine value (gI <sub>2</sub> /100g)						2.0 max	
polarity							
HLB				14.5 <sup>120</sup> , ~14 <sup>121</sup>		14	

**Table 6. Physical and Chemical Properties**

	<b>Polyglyceryl-10 Decaoleate</b>	<b>Polyglyceryl-3 Di- Hydroxystearate</b>	<b>Polyglyceryl-2 Diisostearate</b>	<b>Polyglyceryl-3 Diisostearate)<sup>34</sup></b>	<b>Polyglyceryl-6 Diisostearate<sup>122</sup></b>	<b>Polyglyceryl-3 Diolate<sup>26,123</sup></b>	<b>Polyglyceryl-6 Diolate<sup>124</sup></b>
physical characteristics		solid	clear pale yellow, homogenous liquid <sup>33</sup>	slightly yellowish, viscous liquid	pale yellow liquid	viscous yellow liquid	
molecular wt						766.13 <sup>125</sup>	991.38
solubility		slightly soluble in water		< 0.15 mg/L (water)		dispersible in water; soluble in many organic solvents	
melting point (°C)			-10 <sup>33</sup>				
density (g/ml)			0.941 g/cm <sup>3</sup> <sup>33</sup>				
specific gravity (g/ml)						0.99	
pH							
refractive index (20°C)				8.129 (predicted)			
saponification value	170.9 <sup>31</sup> ; 177.5 <sup>32</sup>						
acid value (mg KOH/g)	14.0 <sup>31</sup>						
hydroxyl value (mg KOH/g)	23.0 <sup>32</sup> ; 40.0 <sup>31</sup>						
peroxide value (meq of active oxygen/Kg)	3.4 <sup>32</sup>						
iodine value (gI <sub>2</sub> /100g)	66.2 <sup>32</sup>						
polarity							
HLB				1.4 (predicted)	8	3	

Table 6. Physical and Chemical Properties

	Polyglyceryl-10 Dipalmitate <sup>126,126</sup>	Polyglyceryl-3 Distearate <sup>127</sup>	Polyglyceryl-6 Distearate	Polyglyceryl-10 Distearate <sup>128</sup>	Polyglyceryl-2 Iso- palmitate/Sebacate <sup>129</sup>	Polyglyceryl-2 Isostearate <sup>130</sup>	Polyglyceryl-4 Isostearate <sup>131</sup>
physical characteristics	beads or waxy solids	white or slightly yellowish powder	waxy solid <sup>126</sup>	yellow waxy solid	liquid		yellow liquid
molecular wt			995.43 <sup>132</sup>			450.65	
solubility		at 20°C: forms liquid crystals in water, etha- nol, and glycerin; insol- uble in propylene gly- col; forms a solid wax with wheat germ, avo- cado, and paraffin oils, and squalene; at 65°C: dispersible in water, clearly soluble in ethanol, in wheat germ, avocado, and paraffin oils, and squalene; tur- bid solubility in glycer- in; insoluble in propyl- ene glycol			slightly soluble to soluble in water		
melting point (°C)				50-58			
density (g/ml)							
specific gravity (g/ml)							
pH							
refractive index (20°C)							
saponification value		140-180		105-125			
acid value (mg KOH/g)				2.0			
hydroxyl value (mg KOH/g)							
peroxide value (meq of active oxygen/Kg)		≤1.0					
iodine value (gI <sub>2</sub> /100g)		≤1.0		3.0			
polarity							
HLB	11		6 <sup>133</sup> ; 8 <sup>126</sup>	~11			~5

**Table 6. Physical and Chemical Properties**

	<b>Polyglyceryl-3 Laurate<sup>134</sup></b>	<b>Polyglyceryl-4 Laurate</b>	<b>Polyglyceryl-10 Laurate</b>	<b>Polyglyceryl-10 Myristate<sup>135</sup></b>	<b>Polyglyceryl-3 Oleate</b>	<b>Polyglyceryl-4 Oleate</b>	<b>Polyglyceryl-10 Oleate</b>
physical characteristics	viscous liquid	viscous liquid <sup>136</sup>	light yellow viscous liquid <sup>6</sup>		yellow liquid <sup>137</sup>	amber liquid with an ester-like odor <sup>138</sup>	waxy solid <sup>25</sup>
molecular weight	422 (average)		349.48 <sup>125</sup>			504.7 <sup>125</sup>	1203.41 <sup>139</sup>
solubility						dispersible in water <sup>138</sup>	
melting point (°C)							
density (g/ml)						0.99 g/cm <sup>3</sup> <sup>138</sup>	
specific gravity (g/ml)							
pH							
refractive index (20°C)							
saponification value	128-144		30-45; 63-83 <sup>6</sup>	60-70	115 <sup>31</sup>		92.1 <sup>31</sup>
acid value (mg KOH/g)	6 max			5 max	1.5 <sup>31</sup>		4.2 <sup>31</sup>
hydroxyl value (mg KOH/g)							337 <sup>31</sup>
peroxide value (meq of active oxygen/Kg)							
iodine value (gI <sub>2</sub> /100g)							
polarity		non-ionic <sup>136</sup>			lipophilic <sup>137</sup>		
HLB		~11			~5 <sup>137</sup>		13 <sup>140</sup>
	<b>Polyglyceryl-10 Palmate<sup>141</sup></b>	<b>Polyglyceryl-6 Pentacaprylate<sup>142</sup></b>	<b>Polyglyceryl-3 Pentacaprylate/ Caprate<sup>143</sup></b>	<b>Polyglyceryl-3 Pentaoleate<sup>144</sup></b>	<b>Polyglyceryl-10 Pentaoleate<sup>145,146</sup></b>	<b>Polyglyceryl-4 Pentastearate<sup>147</sup></b>	<b>Polyglyceryl-6 Pentastearate<sup>148,149</sup></b>
physical characteristics	liquid	liquid	liquid	amber viscous liquid	pale yellow to red-yellow viscous liquid	white to pale yellow pellet	pale yellow waxy solid
molecular wt							
solubility	slightly soluble to soluble in water	slightly soluble in water					easy to soluble in oil and organic solvent, and disperse into hot water
melting point (°C)							53-60
density (g/ml)							
specific gravity (g/ml)							
pH							
refractive index (20°C)							
saponification value				170-200			125-140
acid value (mg KOH/g)				5.0 max			2.0
hydroxyl value (mg KOH/g)							
peroxide value (meq of active oxygen/Kg)							
iodine value (gI <sub>2</sub> /100g)							3.0
polarity				non-ionic <sup>144</sup>			
HLB			3.0		3.5		~7.0

**Table 6. Physical and Chemical Properties**

	<b>Polyglyceryl-10 Pentastearate<sup>150,151</sup></b>	<b>Polyglyceryl-3 Rice Branate<sup>152</sup></b>	<b>Polyglyceryl-3 Ricinoate<sup>153</sup></b>	<b>Polyglyceryl-2 Sesquicaprylate</b>	<b>Polyglyceryl-2 Sesquioleate<sup>154</sup></b>	<b>Polyglyceryl-3 Soyate/Shea Butterate<sup>155</sup></b>	<b>Polyglyceryl-3 Stearate<sup>126</sup></b>
physical characteristics	white to pale yellow solid	light ivory (waxy solid (flakes)		yellow, transparent liquid <sup>156</sup>	highly viscous liquid	liquid	granules
molecular wt	2091.15						
solubility		dispersible in water; miscible in oils		insoluble in water, soluble in castor oil, ethanol, mineral oil <sup>156</sup>		slightly soluble to soluble in water	
melting point (°C)							
density (g/ml)		>1 g/ml (25°C)					
specific gravity (g/ml)							0.89-0.92 (25°C)
pH							
refractive index (20°C)							
saponification value							
acid value (mg KOH/g)							
hydroxyl value (mg KOH/g)							
peroxide value (meq of active oxygen/Kg)							
iodine value (gI <sub>2</sub> /100g)							
polarity		non-ionic		hydrophobic; non-ionic <sup>156</sup>			
HLB	3.5		4		~4		
	<b>Polyglyceryl-4 Stearate</b>	<b>Polyglyceryl-10 Stearate<sup>125,157</sup></b>	<b>Polyglyceryl-2 Tetraisostearate<sup>156</sup></b>	<b>Polyglyceryl-10 Tetraoleate<sup>158</sup></b>	<b>Polyglyceryl-2 Tetrastearate<sup>159</sup></b>	<b>Polyglyceryl-10 Tricocoate<sup>160</sup></b>	<b>Polyglyceryl-10 Tridecanoate<sup>161</sup></b>
physical characteristics		pale yellow to light yellow liquid or solid	yellow liquid	viscous amber to brown liquid		pale yellow viscous liquid	liquid
molecular wt	580.79 <sup>125</sup>	432.64			1095.97		
solubility			soluble in low and high polar esters and in vegetable oil, castor oil, and mineral oil; insoluble in water and ethanol	insoluble in water		insoluble in water	slightly soluble in water
melting point (°C)							
density (g/ml)							
specific gravity (g/ml)			0.926	1.01			
pH							
refractive index (20°C)			1.466				
saponification value							
acid value (mg KOH/g)							
hydroxyl value (mg KOH/g)							
peroxide value (meq of active oxygen/Kg)							
iodine value (gI <sub>2</sub> /100g)							
polarity		hydrophilic					
HLB		12.0					

**Table 6. Physical and Chemical Properties**

	<b>Polyglyceryl-10 Triisostearate<sup>162,163</sup></b>	<b>Polyglyceryl-10 Trioleate<sup>164</sup></b>	<b>Polyglyceryl-10 Tristearate<sup>165</sup></b>	<b>Rice Brain Oil Polyglyceryl-3 Esters</b>	<b>Safflower Seed Oil Polyglyceryl-6 Esters<sup>101</sup></b>	<b>Schinziophyton Rautanenii Kernel Oil Polyglyceryl-6 Esters<sup>102</sup></b>	<b>Sclerocarya Birrea Seed Oil Polygly- ceryl-6 Esters<sup>103</sup></b>
physical characteristics	pale yellow liquid	light yellow to red- yellow viscous liquid	white to pale yellow waxy substance	oily limpid liquid <sup>166</sup> clear, oily, amber-colored liquid <sup>167</sup>	amber (physical state not specified)	brown liquid	amber liquid
molecular wt							
solubility	insoluble in water			dispersible in water; miscible in oils <sup>166</sup>	water dispersible	water dispersible	water dispersible
melting point (°C)							
density (g/ml)				>1	<1	<1	<1
specific gravity (g/ml)							
pH							
refractive index (20°C)					approx. 1.47	approx. 1.47	approx.. 1.47
saponification value						145-165	145-165
acid value (mg KOH/g)					< 5	< 5	<5
hydroxyl value (mg KOH/g)							
peroxide value (meq of active oxygen/Kg)					<10	<10	<10
iodine value (gI <sub>2</sub> /100g)						95-110	50-65
polarity				non-ionic		non-ionic, amphiphilic	non-ionic, amphiphilic
HLB	8	7.0	7.5				

	<b>Sesame Oil Polyglyceryl-6 Esters<sup>104</sup></b>	<b>Shea Butter Polyglyceryl-6 Esters<sup>105</sup></b>	<b>Soybean Oil Polyglyceryl-6 Esters<sup>106</sup></b>	<b>Sunflower Seed Oil Polyglyceryl-10 Esters<sup>108</sup></b>	<b>Sweet Almond Oil Polyglyceryl-6 Esters<sup>109</sup></b>	<b>Trichilia Emetica Seed Oil Polyglyceryl-6 Esters<sup>110</sup></b>	<b>Triisostearoyl Polyglyceryl-3 Dimer Dilinoate<sup>50,168,169</sup></b>
physical characteristics	amber liquid	beige solid	dark orange liquid	amber viscous liquid	amber liquid	dark brown soft paste	hazy, viscous liquid
molecular wt							>1000
solubility	water dispersible	water dispersible	water dispersible	water dispersible	water dispersible	water dispersible	
melting point (°C)		35-45					
density (g/ml)	<1	<1	<1	>1	<1	<1	
specific gravity (g/ml)							
pH							
refractive index (20°C)	approx.. 1.47	approx.. 1.47	approx. 1.47	approx. 1.47	approx.. 1.47	approx.. 1.47	
saponification value	140-160	135-165	145-165	115-135	130-160	140-160	160-180
acid value (mg KOH/g)	<5	<5		< 5	<5	<5	≤10
hydroxyl value (mg KOH/g)							
peroxide value (meq of active oxygen/Kg)	<10	<10		<10	<10	<10	
iodine value (gI <sub>2</sub> /100g)	75-90	45-60	90-105	50-60	70-85	50-65	≤10
polarity	non-ionic, amphiphilic	non-ionic, amphiphilic	non-ionic, amphiphilic	non-ionic, amphiphilic	non-ionic, amphiphilic	non-ionic, amphiphilic	
HLB							

Table 6. Physical and Chemical Properties

Ximenia Americana	
Seed Oil	
Polyglyceryl-6	
Esters <sup>170</sup>	
physical characteristics	oil
molecular wt	
solubility	hydrodispersible - water soluble
melting point (°C)	
density (g/ml)	
specific gravity (g/ml)	
pH	
refractive index (20°C)	
saponification value	
acid value (mg KOH/g)	
hydroxyl value (mg KOH/g)	
peroxide value (meq of active oxygen/Kg)	
iodine value (gI <sub>2</sub> /100g)	
polarity	
HLB	

**Table 7. Specifications, Impurities, and/or Constituents**

Ingredient	Specifications/Impurities/Constituents	Reference
Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate	PEG-free	113
Polyglyceryl-4 Caprate	PEG-free	120
Polyglyceryl-6 Distearate	100% vegetable-derived ; PEG-free	133,171
Polyglyceryl-10 Distearate	arsenic = 0.002; heavy metals = 0.005	128
Polyglyceryl-4 Laurate	PEG-free	136
Polyglyceryl-4 Oleate	100 ppm D,L-tocopherol; <1% volatiles	138
Polyglyceryl-10 Myristate	2 ppm arsenic; 20 ppm heavy metals	135

Abbreviations: BHT - butylated hydroxytoluene; EG – polyethylene glycol

**Table 8. Frequency and concentration of use according to duration and type of exposure**

	# of Uses <sup>9</sup>	Max Conc of Use (%) <sup>10-14</sup>	# of Uses <sup>9</sup>	Max Conc of Use (%) <sup>10-14</sup>	# of Uses <sup>9</sup>	Max Conc of Use (%) <sup>10-14</sup>
	<b>Babassu Oil Polyglyceryl-4 Esters</b>		<b>Babassu Oil Polyglyceryl-6 Esters</b>		<b>Candelilla/Jojoba/Rice Bran Polyglyceryl-3 Esters</b>	
<b>Totals*</b>	<b>18</b>	<b>2.3</b>	<b>1</b>	<b>NR</b>	<b>16</b>	<b>0.5-2</b>
<b>Duration of Use</b>						
<i>Leave-On</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>16</i>	<i>0.5-2</i>
<i>Rinse-Off</i>	<i>18</i>	<i>2.3</i>	<i>1</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Diluted for (Bath) Use</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	6	NR
Incidental Ingestion	NR	NR	NR	NR	1	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	4 <sup>a</sup> ; 1 <sup>b</sup>	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	1 <sup>b</sup>	NR
Dermal Contact	1	2.3	1	NR	15	0.5-2
Deodorant (underarm)	NR	NR	NR	NR	NR	aerosol: 0.5
Hair - Non-Coloring	17	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	1	NR
Baby Products	NR	NR	NR	NR	1	1.5
	<b>Coconut Oil Polyglyceryl-6 Esters</b>		<b>Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate</b>		<b>Glyceryl/Polyglyceryl-6 Isostearate/Behenate Esters</b>	
<b>Totals*</b>	<b>2</b>	<b>NR</b>	<b>3</b>	<b>2-4</b>	<b>10</b>	<b>2</b>
<b>Duration of Use</b>						
<i>Leave-On</i>	<i>NR</i>	<i>NR</i>	<i>3</i>	<i>2-4</i>	<i>10</i>	<i>2</i>
<i>Rinse Off</i>	<i>2</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<i>Diluted for (Bath) Use</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<b>Exposure Type</b>						
Eye Area	NR	NR	1	NR	2	NR
Incidental Ingestion	NR	NR	NR	NR	2	NR
Incidental Inhalation-Spray	NR	NR	2 <sup>a</sup>	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	2	NR	3	2-4	8	2
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	1	NR	NR	NR	2	NR
Baby Products	NR	NR	NR	NR	NR	NR



**Table 8. Frequency and concentration of use according to duration and type of exposure**

	# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>	
	<b>Macadamia Seed Oil Polyglyceryl-6 Esters Behenate</b>		<b>Palm Oil Polyglyceryl-4 Esters</b>		<b>Polyglyceryl-2 Caprate</b>	
	<b>4</b>	<b>2-25</b>	<b>1</b>	<b>NR</b>	<b>5</b>	<b>NR</b>
<b>Duration of Use</b>						
Leave-On	4	2-25	1	NR	5	NR
Rinse-Off	NR	NR	NR	NR	NR	NR
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	2	2-3	NR	NR	NR	NR
Incidental Ingestion	NR	25	NR	NR	NR	NR
Incidental Inhalation-Spray	1 <sup>a</sup>	NR	1 <sup>b</sup>	NR	4 <sup>b</sup>	NR
Incidental Inhalation-Powder	NR	NR	1 <sup>b</sup>	NR	4 <sup>b</sup>	NR
Dermal Contact	3	2	1	NR	5	NR
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	25	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Polyglyceryl-2 Diisostearate</b>		<b>Polyglyceryl-2 Isopalmitate</b>		<b>Polyglyceryl-2 Isostearate</b>	
<b>Totals</b>	<b>983</b>	<b>0.1-18.8</b>	<b>9</b>	<b>NR</b>	<b>7</b>	<b>1-19.3</b>
<b>Duration of Use</b>						
Leave-On	81	0.1-18.8	9	NR	6	1.6-19.3
Rinse Off	2	0.88-5	NR	NR	1	1
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	6	1.5-4	NR	NR	NR	NR
Incidental Ingestion	33	4-18.8	9	NR	NR	2.3-19.3
Incidental Inhalation-Spray	8 <sup>a</sup> ; 15 <sup>b</sup>	0.25-0.5; 0.48-4 <sup>a</sup>	NR	NR	NR	NR
Incidental Inhalation-Powder	15 <sup>b</sup>	0.1; 0.14-2 <sup>c</sup>	NR	NR	2	2.1 <sup>c</sup>
Dermal Contact	48	0.1-5	NR	NR	7	1-2.5
Deodorant (underarm)	NR	0.1 (not spray)	NR	NR	NR	NR
Hair - Non-Coloring	NR	0.25-15	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	33	4-18.8	9	NR	1	2.3-19.3
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Polyglyceryl-2 Laurate</b>		<b>Polyglyceryl-2 Oleate</b>		<b>Polyglyceryl-2 Sesquiosostearate</b>	
<b>Totals*</b>	<b>9</b>	<b>2-4.6</b>	<b>3</b>	<b>0.009-2.4</b>	<b>11</b>	<b>1.1-7.6</b>
<b>Duration of Use</b>						
Leave-On	6	2	3	0.09-1.6	9	2.1-7.6
Rinse-Off	3	4.6	NR	2.4	2	1.1
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	1	NR	NR	0.27-2.4	NR	2.1
Incidental Ingestion	NR	NR	NR	NR	NR	7.6
Incidental Inhalation-Spray	3 <sup>a</sup> ; 1 <sup>b</sup>	NR	3 <sup>a</sup>	NR	2 <sup>a</sup> ; 2 <sup>b</sup>	NR
Incidental Inhalation-Powder	1 <sup>b</sup>	NR	NR	0.09 <sup>c</sup>	2 <sup>b</sup>	4.4 <sup>c</sup>
Dermal Contact	8	NR	3	0.09-2.4	7	1.1-4.4
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	1	2-4.6	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	2	7.6
Baby Products	NR	NR	NR	NR	NR	NR

**Table 8. Frequency and concentration of use according to duration and type of exposure**

	# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>	
	<b>Polyglyceryl-2 Sesquisteate</b>		<b>Polyglyceryl-2 Stearate</b>		<b>Polyglyceryl-2 Tetraistearate</b>	
<b>Totals*</b>	<b>NR</b>	<b>0.9</b>	<b>NR</b>	<b>0.16-2.2</b>	<b>28</b>	<b>0.5-7</b>
<b>Duration of Use</b>						
Leave-On	NR	NR	NR	0.16-2.2	28	0.5-7
Rinse-Off	NR	0.9	NR	0.2	NR	NR
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	0.2-1	NR	NR
Incidental Ingestion	NR	NR	NR	0.2	25	7
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	2.2 <sup>c</sup>	NR	0.96
Dermal Contact	NR	0.9	NR	0.16-2.2	3	0.5-4.6
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	0.2	25	7
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Polyglyceryl-2 Triisostearate</b>		<b>Polyglyceryl-3 Beeswax</b>		<b>Polyglyceryl-3 Caprate</b>	
<b>Totals</b>	<b>160</b>	<b>0.12-40</b>	<b>63</b>	<b>0.5-5.8</b>	<b>12</b>	<b>NR</b>
<b>Duration of Use</b>						
Leave-On	155	0.12-40	55	0.5-5.8	11	NR
Rinse Off	5	1-4	8	2.5	1	NR
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	20	0.12-20	10	0.8-3	NR	NR
Incidental Ingestion	88	4.1-40	8	3.8-5.8	NR	NR
Incidental Inhalation-Spray	8 <sup>a</sup> ; 2 <sup>b</sup>	NR	1; 12 <sup>a</sup> ; 7 <sup>c</sup>	NR	NR	NR
Incidental Inhalation-Powder	2; 2 <sup>b</sup>	0.49-2; 1-5 <sup>c</sup>	7 <sup>c</sup>	3.4; 4 <sup>c</sup>	NR	NR
Dermal Contact	72	0.12-20	11	0.5-3.4	12	NR
Deodorant (underarm)	NR	NR	NR	NR	11 <sup>a</sup>	NR
Hair - Non-Coloring	NR	NR	NR	NR	NR	NR
Hair-Coloring	NR	3	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	89	4.1-40	8	3.8-5.8	1	NR
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Polyglyceryl-3 Caprylate</b>		<b>Polyglyceryl-3 Dicitrate/Stearate</b>		<b>Polyglyceryl-3 Diisostearate</b>	
<b>Totals*</b>	<b>11</b>	<b>0.05-1</b>	<b>4</b>	<b>2-4</b>	<b>356</b>	<b>0.00000015-39</b>
<b>Duration of Use</b>						
Leave-On	8	0.05-1	4	2-4	350	0.00000015-39
Rinse-Off	3	0.6	NR	NR	5	0.000025-29.7
Diluted for (Bath) Use	NR	NR	NR	NR	1	0.5
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	41	0.006-12.2
Incidental Ingestion	NR	NR	NR	NR	206	7.8-39
Incidental Inhalation-Spray	1 <sup>b</sup>	0.05	4 <sup>a</sup>	NR	34 <sup>a</sup> ; 24 <sup>b</sup>	0.00000015-0.5
Incidental Inhalation-Powder	NR	0.05 <sup>c</sup>	NR	2-4 <sup>c</sup>	24 <sup>b</sup>	0.25; 0.03-1 <sup>c</sup>
Dermal Contact	11	0.05-1	1	2-4	143	0.003-12.2
Deodorant (underarm)	6 <sup>a</sup>	not spray: 0.5-1; aerosol: 0.6	NR	NR	NR	0.003-0.3 (not spray)
Hair - Non-Coloring	NR	NR	3	2.2	NR	0.00000015-0.003
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	2	0.6	NR	NR	210	0.003-29.7
Baby Products	NR	NR	NR	NR	NR	2

**Table 8. Frequency and concentration of use according to duration and type of exposure**

	# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>	
	<b>Polyglyceryl-3 Distearate</b>		<b>Polyglyceryl-3 Isostearate</b>		<b>Polyglyceryl-3 Laurate</b>	
<b>Totals*</b>	<b>8</b>	<b>0.02-3</b>	<b>11</b>	<b>NR</b>	<b>118</b>	<b>0.6-6</b>
<b>Duration of Use</b>						
<i>Leave-On</i>	5	0.02-3	9	NR	2	6
<i>Rinse-Off</i>	3	NR	2	NR	116	0.6-2
<i>Diluted for (Bath) Use</i>	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	0.02-0.066	1	NR	NR	6
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	1 <sup>a</sup>	3	3 <sup>a</sup> , 4 <sup>b</sup>	NR	1 <sup>a</sup> , 1 <sup>b</sup>	NR
Incidental Inhalation-Powder	NR	0.29 <sup>c</sup>	4 <sup>b</sup>	NR	1 <sup>b</sup>	NR
Dermal Contact	4	0.29-1.3	11	NR	109	2-6
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	4	1	NR	NR	9	0.6-2
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	NR	NR	106	NR
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Polyglyceryl-3 Oleate</b>		<b>Polyglyceryl-3 Pentaricinoleate</b>		<b>Polyglyceryl-3 Ricinoleate</b>	
<b>Totals</b>	<b>14</b>	<b>1.2-1.5</b>	<b>NR</b>	<b>0.15</b>	<b>62</b>	<b>0.25-2</b>
<b>Duration of Use</b>						
<i>Leave-On</i>	11	1.2-1.5	NR	0.15	62	0.25-2
<i>Rinse Off</i>	3	NR	NR	NR	NR	NR
<i>Diluted for (Bath) Use</i>	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	2	1.5	NR	0.15	5	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	6 <sup>a</sup> , 2 <sup>b</sup>	NR	NR	NR	51 <sup>a</sup> , 2 <sup>b</sup>	NR
Incidental Inhalation-Powder	2 <sup>b</sup>	NR	NR	NR	2 <sup>b</sup>	0.25
Dermal Contact	14	1.5	NR	0.15	57	0.25-2
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	1.2	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>Polyglyceryl-3 Stearate</b>		<b>Polyglyceryl-4 Caprate</b>		<b>Polyglyceryl-4 Isostearate</b>	
<b>Totals*</b>	<b>15</b>	<b>0.5-0.61</b>	<b>15</b>	<b>0.5-1.5</b>	<b>269</b>	<b>0.067-24.1</b>
<b>Duration of Use</b>						
<i>Leave-On</i>	12	0.5-0.54	5	0.5-1.5	268	0.067-24.1
<i>Rinse-Off</i>	3	0.61	9	0.9-1.5	1	0.16-1.7
<i>Diluted for (Bath) Use</i>	NR	NR	1	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	2	NR	50	1.2-24.1
Incidental Ingestion	1	0.5	NR	NR	41	0.067-10.9
Incidental Inhalation-Spray	2 <sup>a</sup> , 8 <sup>b</sup>	NR	1 <sup>a</sup> , 2 <sup>b</sup>	0.5 <sup>a</sup>	18 <sup>a</sup> , 8 <sup>b</sup>	0.26; 1.1-2.1 <sup>a</sup>
Incidental Inhalation-Powder	8 <sup>b</sup>	NR	2 <sup>b</sup>	0.72 <sup>c</sup>	3; 8 <sup>b</sup> , 1 <sup>c</sup>	0.17; 0.5-2.5 <sup>c</sup>
Dermal Contact	14	0.54-0.61	14	0.72-1.5	222	0.067-24.1
Deodorant (underarm)	NR	NR	1 <sup>a</sup>	1.5 (not spray)	NR	NR
Hair - Non-Coloring	NR	NR	1	0.5-1.1	2	2.1
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	1	0.5	4	1-1.5	41	0.067-10.9
Baby Products	NR	NR	NR	NR	1	1

**Table 8. Frequency and concentration of use according to duration and type of exposure**

	# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>	
	<b>Polyglyceryl-4 Laurate</b>		<b>Polyglyceryl-4 Oleate</b>		<b>Polyglyceryl-5 Dioleate</b>	
<b>Totals*</b>	<b>10</b>	<b>0.47</b>	<b>7</b>	<b>1.8</b>	<b>1</b>	<b>NR</b>
<b>Duration of Use</b>						
Leave-On	9	NR	7	1.8	NR	NR
Rinse-Off	1	0.47	NR	NR	1	NR
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	1	NR	2	NR	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	4 <sup>a</sup>	NR	3 <sup>a</sup>	1.8	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	10	0.47	7	1.8	1	NR
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	1	NR
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Polyglyceryl-5 Isostearate</b>		<b>Polyglyceryl-5 Laurate</b>		<b>Polyglyceryl-5 Oleate</b>	
<b>Totals</b>	<b>2</b>	<b>NR</b>	<b>2</b>	<b>0.6</b>	<b>10</b>	<b>0.35</b>
<b>Duration of Use</b>						
Leave-On	2	NR	NR	0.6	8	0.35
Rinse Off	NR	NR	1	0.6	2	NR
Diluted for (Bath) Use	NR	NR	1	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	1	NR	NR	NR	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	1 <sup>b</sup>	NR	NR	NR	6 <sup>a</sup>	0.35 <sup>c</sup>
Incidental Inhalation-Powder	1 <sup>b</sup>	NR	NR	0.6 <sup>c</sup>	NR	NR
Dermal Contact	2	NR	2	0.6	10	0.35
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	2	NR	1	NR
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Polyglyceryl-5 Stearate</b>		<b>Polyglyceryl-5 Triisostearate</b>		<b>Polyglyceryl-5 Trioleate</b>	
<b>Totals*</b>	<b>NR</b>	<b>1</b>	<b>NR</b>	<b>1-5</b>	<b>6</b>	<b>2.8</b>
<b>Duration of Use</b>						
Leave-On	NR	1	NR	1-5	6	NR
Rinse-Off	NR	NR	NR	NR	NR	2.8
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	5	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	1 <sup>a</sup> , 5 <sup>b</sup>	NR
Incidental Inhalation-Powder	NR	1 <sup>c</sup>	NR	NR	5 <sup>b</sup>	NR
Dermal Contact	NR	1	NR	1	6	NR
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	NR	2.8
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	NR	NR	5	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR

**Table 8. Frequency and concentration of use according to duration and type of exposure**

	# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>	
	<b>Polyglyceryl-6 Caprylate/Caprate</b>		<b>Polyglyceryl-6 Dioleate</b>		<b>Polyglyceryl-6 Distearate</b>	
<b>Totals*</b>	NR	0.75	27	1.8-2.4	22	4-22.4
<b>Duration of Use</b>						
<i>Leave-On</i>	NR	NR	20	2.4	21	4-22.4
<i>Rinse-Off</i>	NR	0.75	7	1.8	1	NR
<i>Diluted for (Bath) Use</i>	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	4	4
Incidental Ingestion	NR	NR	2	NR	1	22.4
Incidental Inhalation-Spray	NR	NR	2 <sup>a</sup> , 7 <sup>b</sup>	NR	7 <sup>a</sup> , 8 <sup>b</sup>	NR
Incidental Inhalation-Powder	NR	NR	7 <sup>b</sup>	2.4 <sup>c</sup>	8 <sup>b</sup> , 1 <sup>c</sup>	NR
Dermal Contact	NR	NR	19	2.4	19	4-10.5
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	0.75	6	1.8	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	5
Mucous Membrane	NR	NR	2	NR	2	22.4
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Polyglyceryl-6 Isostearate</b>		<b>Polyglyceryl-6 Octastearate</b>		<b>Polyglyceryl-6 Oleate</b>	
<b>Totals</b>	14	NR	1	NR	1	NR
<b>Duration of Use</b>						
<i>Leave-On</i>	14	NR	1	NR	1	NR
<i>Rinse Off</i>	NR	NR	NR	NR	NR	NR
<i>Diluted for (Bath) Use</i>	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	NR	NR
Incidental Ingestion	1	NR	NR	NR	NR	NR
Incidental Inhalation-Spray	4 <sup>a</sup> , 8 <sup>b</sup>	NR	1 <sup>a</sup>	NR	1 <sup>b</sup>	NR
Incidental Inhalation-Powder	8 <sup>b</sup>	NR	NR	NR	1 <sup>b</sup>	NR
Dermal Contact	13	NR	1	NR	1	NR
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	1	NR	NR	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Polyglyceryl-6 Pentastearate</b>		<b>Polyglyceryl-6 Ricinoleate</b>		<b>Polyglyceryl-6 Tricaprylate</b>	
<b>Totals*</b>	NR	5	1	NR	NR	3.6
<b>Duration of Use</b>						
<i>Leave-On</i>	NR	5	1	NR	NR	3.6
<i>Rinse-Off</i>	NR	NR	NR	NR	NR	NR
<i>Diluted for (Bath) Use</i>	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	5	NR	NR	NR	NR
Incidental Ingestion	NR	NR	1	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	NR	5	NR	NR	NR	3.6
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	1	NR	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR

**Table 8. Frequency and concentration of use according to duration and type of exposure**

	# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>	
	<b>Polyglyceryl-8 Decabehenate/Caprate</b>		<b>Polyglyceryl-8 Decaerucate/Decaisostearate/Decaricinoleate</b>		<b>Polyglyceryl-10 Behenate/Eicosadioate</b>	
<b>Totals*</b>	<b>NR</b>	<b>9</b>	<b>1</b>	<b>NR</b>	<b>2</b>	<b>2-5</b>
<b>Duration of Use</b>						
<i>Leave-On</i>	<i>NR</i>	<i>9</i>	<i>1</i>	<i>NR</i>	<i>1</i>	<i>2</i>
<i>Rinse-Off</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>1</i>	<i>5</i>
<i>Diluted for (Bath) Use</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	NR	NR
Incidental Ingestion	NR	9	NR	NR	NR	2
Incidental Inhalation-Spray	NR	NR	1 <sup>b</sup>	NR	NR	NR
Incidental Inhalation-Powder	NR	NR	1 <sup>b</sup>	NR	NR	NR
Dermal Contact	NR	NR	1	NR	2	5
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	NR	NR	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	9	NR	NR	NR	2
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Polyglyceryl-10 Decaisostearate</b>		<b>Polyglyceryl-10 Decaoleate</b>		<b>Polyglyceryl-10 Diisostearate</b>	
<b>Totals</b>	<b>NR</b>	<b>2.7</b>	<b>10</b>	<b>0.01-5</b>	<b>9</b>	<b>0.8-17</b>
<b>Duration of Use</b>						
<i>Leave-On</i>	<i>NR</i>	<i>2.7</i>	<i>10</i>	<i>1-5</i>	<i>8</i>	<i>0.8-2</i>
<i>Rinse Off</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>0.01</i>	<i>1</i>	<i>1.6-17</i>
<i>Diluted for (Bath) Use</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>	<i>NR</i>
<b>Exposure Type</b>						
Eye Area	NR	2.7	NR	NR	NR	NR
Incidental Ingestion	NR	NR	3	5	NR	NR
Incidental Inhalation-Spray	NR	NR	4 <sup>a</sup>	NR	3 <sup>a</sup> , 4 <sup>b</sup>	2 <sup>a</sup>
Incidental Inhalation-Powder	NR	NR	NR	NR	4 <sup>b</sup>	0.8 <sup>c</sup>
Dermal Contact	NR	2.7	7	1-5	9	0.8-17
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	NR	3	0.01	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Polyglyceryl-10 Dioleate</b>		<b>Polyglyceryl-10 Dipalmitate</b>		<b>Polyglyceryl-10 Distearate</b>	
<b>Totals*</b>	<b>NR</b>	<b>3.9</b>	<b>17</b>	<b>2-10</b>	<b>10</b>	<b>NR</b>
<b>Duration of Use</b>						
<i>Leave-On</i>	<i>NR</i>	<i>NR</i>	<i>3</i>	<i>10</i>	<i>9</i>	<i>NR</i>
<i>Rinse-Off</i>	<i>NR</i>	<i>NR</i>	<i>12</i>	<i>2</i>	<i>1</i>	<i>NR</i>
<i>Diluted for (Bath) Use</i>	<i>NR</i>	<i>NR</i>	<i>2</i>	<i>2</i>	<i>NR</i>	<i>NR</i>
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	NR	NR
Incidental Ingestion	NR	NR	1	NR	NR	NR
Incidental Inhalation-Spray	NR	NR	1 <sup>b</sup>	NR	9 <sup>a</sup>	NR
Incidental Inhalation-Powder	NR	NR	1 <sup>b</sup>	10 <sup>c</sup>	NR	NR
Dermal Contact	NR	3.9	16	2-10	10	NR
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	12	2	1	NR
Baby Products	NR	NR	NR	NR	NR	NR

**Table 8. Frequency and concentration of use according to duration and type of exposure**

	# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>		# of Uses <sup>9</sup> Max Conc of Use (%) <sup>10-14</sup>	
	<b>Polyglyceryl-10 Heptahydroxystearate</b>		<b>Polyglyceryl-10 Hydroxystearate/ Stearate/Eicosadioate</b>		<b>Polyglyceryl-10 Isostearate</b>	
<b>Totals*</b>	<b>NR</b>	<b>1-2</b>	<b>2</b>	<b>0.62-1.8</b>	<b>3</b>	<b>0.6</b>
<b>Duration of Use</b>						
<i>Leave-On</i>	NR	1-2	1	0.62-1.2	NR	0.6
<i>Rinse-Off</i>	NR	NR	1	1.8	NR	NR
<i>Diluted for (Bath) Use</i>	NR	NR	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	NR	NR	NR	NR	NR
Incidental Ingestion	NR	2	NR	0.62-1.2	NR	NR
Incidental Inhalation-Spray	NR	NR	NR	NR	3 <sup>a</sup>	0.6 (pump spray)
Incidental Inhalation-Powder	NR	NR	NR	NR	NR	NR
Dermal Contact	NR	1	2	1.8	3	0.6
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	2	NR	0.62-1.2	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR
	<b>Polyglyceryl-10 Laurate</b>		<b>Polyglyceryl-10 Myristate</b>		<b>Polyglyceryl-10 Nonaisostearate</b>	
<b>Totals</b>	<b>44</b>	<b>0.0009-6.5</b>	<b>18</b>	<b>0.0003-1.2</b>	<b>58</b>	<b>0.5</b>
<b>Duration of Use</b>						
<i>Leave-On</i>	36	0.0009-6.5	11	0.0003-1.2	58	NR
<i>Rinse Off</i>	8	0.2-5	7	0.0003-0.04	NR	0.5
<i>Diluted for (Bath) Use</i>	NR	0.69-2	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	5	NR	1	NR	23	NR
Incidental Ingestion	NR	NR	NR	NR	26	NR
Incidental Inhalation-Spray	11 <sup>a</sup> ; 9 <sup>b</sup>	0.5; 6.5 <sup>a</sup>	6 <sup>a</sup> ; 3 <sup>b</sup>	NR	NR	NR
Incidental Inhalation-Powder	9 <sup>b</sup>	NR	3 <sup>b</sup>	0.8 <sup>c</sup>	NR	NR
Dermal Contact	39	0.0009-2	17	0.0003-1.2	32	0.5
Deodorant (underarm)	NR	NR	NR	not spray: 0.0003 aerosol: 0.1	NR	NR
Hair - Non-Coloring	5	0.5-6.5	1	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	2	NR	NR	26	NR
Baby Products	6	1	1	NR	NR	NR
	<b>Polyglyceryl-10 Oleate</b>		<b>Polyglyceryl-10 Pentahydroxystearate</b>		<b>Polyglyceryl-10 Pentaisostearate</b>	
<b>Totals*</b>	<b>26</b>	<b>0.0000085-3</b>	<b>3</b>	<b>NR</b>	<b>NR</b>	<b>2-4.8</b>
<b>Duration of Use</b>						
<i>Leave-On</i>	19	0.21-3	2	NR	NR	2-4.8
<i>Rinse-Off</i>	7	0.0000085	1	NR	NR	NR
<i>Diluted for (Bath) Use</i>	NR	2	NR	NR	NR	NR
<b>Exposure Type</b>						
Eye Area	NR	0.63	1	NR	NR	NR
Incidental Ingestion	NR	NR	NR	NR	NR	4.8
Incidental Inhalation-Spray	10 <sup>a</sup> ; 7 <sup>b</sup>	1	1 <sup>a</sup>	NR	NR	NR
Incidental Inhalation-Powder	7 <sup>b</sup>	0.21-3 <sup>c</sup>	NR	NR	NR	2 <sup>c</sup>
Dermal Contact	21	0.0000085-3	NR	NR	NR	2
Deodorant (underarm)	NR	NR	2	NR	NR	NR
Hair - Non-Coloring	5	0.0000085-1	NR	NR	NR	NR
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	NR	2	NR	NR	NR	4.8
Baby Products	1	NR	NR	NR	NR	NR

**Table 8. Frequency and concentration of use according to duration and type of exposure**

	# of Uses <sup>9</sup>	Max Conc of Use (%) <sup>10-14</sup>	# of Uses <sup>9</sup>	Max Conc of Use (%) <sup>10-14</sup>	# of Uses <sup>9</sup>	Max Conc of Use (%) <sup>10-14</sup>
	Polyglyceryl-10 Pentaoleate		Polyglyceryl-10 Pentastearate		Polyglyceryl-10 Stearate	
Totals*	5	1-2.6	13	0.0003-2.2	89	0.13-2
Duration of Use						
Leave-On	5	1-2.6	11	0.0003-2.2	82	0.13-2
Rinse-Off	NR	NR	2	0.0003-0.1	7	1
Diluted for (Bath) Use	NR	NR	NR	NR	NR	NR
Exposure Type						
Eye Area	1	NR	1	NR	11	0.41-1.8
Incidental Ingestion	1	2.6	NR	0.0003-2	NR	NR
Incidental Inhalation-Spray	1; 1 <sup>a</sup>	1 <sup>a</sup>	6 <sup>a</sup> ; 3 <sup>b</sup>	NR	28 <sup>a</sup> ; 30 <sup>b</sup>	0.25 <sup>a</sup>
Incidental Inhalation-Powder	NR	NR	3 <sup>b</sup>	1-2.2 <sup>c</sup>	30 <sup>b</sup>	0.13-2 <sup>c</sup>
Dermal Contact	2	NR	12	0.0003-2.2	88	0.13-2
Deodorant (underarm)	NR	NR	NR	NR	NR	NR
Hair - Non-Coloring	2	1	1	NR	1	0.25
Hair-Coloring	NR	NR	NR	NR	NR	NR
Nail	NR	NR	NR	NR	NR	NR
Mucous Membrane	1	2.6	NR	0.0003-2	NR	NR
Baby Products	NR	NR	NR	NR	NR	NR
	Polyglyceryl-10 Tristearate		Triisostearoyl Polyglyceryl-3 Dimer Dilinoleate			
Totals*	1	NR	19	1-11.2		
Duration of Use						
Leave-On	1	NR	19	1-11.2		
Rinse-Off	NR	NR	NR	NR		
Diluted for (Bath) Use	NR	NR	NR	NR		
Exposure Type						
Eye Area	1	NR	1	1-1.2		
Incidental Ingestion	NR	NR	17	9-11.2		
Incidental Inhalation-Spray	NR	NR	NR	NR		
Incidental Inhalation-Powder	NR	NR	NR	NR		
Dermal Contact	1	NR	2	1-1.2		
Deodorant (underarm)	NR	NR	NR	NR		
Hair - Non-Coloring	NR	NR	NR	NR		
Hair-Coloring	NR	NR	NR	NR		
Nail	NR	NR	NR	NR		
Mucous Membrane	NR	NR	17	9-11.2		
Baby Products	NR	NR	NR	NR		

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

<sup>a</sup> Includes products that can be sprays, but it is not known whether the reported uses are sprays

<sup>b</sup> Not specified whether this product is a spray or a powder or neither, but it is possible it may be a spray or a powder, so this information is captured for both categories of incidental inhalation

<sup>c</sup> Includes products that can be powders, but it is not known whether the reported uses are powders

NR – no reported use

NS – survey results have not yet been received



**Table 9. Supplier Recommended Use Levels**

<b>Ingredient</b>	<b>Supplier-Recommended Concentration</b>	<b>Reference</b>
Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate	3.0%	113
Polyglyceryl-4 Caprate	2-10%	120
Polyglyceryl-3 Caprylate	0.2-2%	117
Polyglyceryl-10 Caprylate/Caprate	1-7%	118
Polyglyceryl-4 Cocoate	1-5%	172
Polyglyceryl-6 Distearate	1-3%	133
	4-6	171
Polyglyceryl-10 Eicosanedioate/Tetradecanedioate	1-10%	173
Polyglyceryl-4 Isostearate	2.5-4%	131
Polyglyceryl-4 Laurate (in o/w lotion wipes)	5.0 - 10.0 % in concentrates 0.5 - 1.0 % in impregnating liquids	136
Polyglyceryl-10 Laurate (~60% pure, with ~40% polyglycerin-10 and ~2% sodium laurate)	≤3%	20
Polyglyceryl-3 Oleate	2.5-4%	137
Polyglyceryl-10 Oleate	1-7%	140
Polyglyceryl-3 Ricinoleate	3.5-4% (w/o emulsions); 5-25% (anhydrous products)	153
Polyglyceryl-2 Sesquioleate	2-3%	154

**Table 10.** Ingredients Not Reported to be Used <sup>9-14</sup>

Adansonia Digitata Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-3 Rice Branate	Polyglyceryl-6 Pentaricinoleate	Polyglyceryl-10 Tetradecanedioate
Almond Oil/Polyglyceryl-10 Esters	Polyglyceryl-3 Soyate/Shea Butterate	Polyglyceryl-6 Schinzioophyton Rautanenii Kernelate	Polyglyceryl-10 Tetralaurate
Apricot Kernel Oil Polyglyceryl-3 Esters	Polyglyceryl-3 Stearate SE	Polyglyceryl-6 Sclerocarya Birrea Seedate	Polyglyceryl-10 Tetraoleate
Apricot Kernel Oil Polyglyceryl-4 Esters	Polyglyceryl-3 Triisostearate	Polyglyceryl-6 Sesquicaprylate	Polyglyceryl-10 Tricoate
Apricot Kernel Oil Polyglyceryl-5 Esters	Polyglyceryl-3 Triolivate	Polyglyceryl-6 Sesquiosostearate	Polyglyceryl-10 Tridecanoate
Apricot Kernel Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Almond/Shea Butterate	Polyglyceryl-6 Sesquisteate	Polyglyceryl-10 Trierucate
Apricot Kernel Oil Polyglyceryl-10 Esters	Polyglyceryl-4 Caprylate	Polyglyceryl-6 Stearate	Polyglyceryl-10 Triisostearate
Argan Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Caprylate/Caprata	Polyglyceryl-6 Tetrabehenate	Polyglyceryl-10 Trilaurate
Astrocaryum Vulgare Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Cocoate	Polyglyceryl-6 Tetracaprylate	Polyglyceryl-10 Trioleate
Avocado Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Dilaurate	Polyglyceryl-6 Tetraoleate	Polyglyceryl-10 Undecylenate
Bertholletia Excelsa Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Distearate	Polyglyceryl-6 Trichilia Emetica Seedate	Polyglyceryl-15 Diisostearate
Borage Seed Oil Polyglyceryl-4 Esters	Polyglyceryl-4 Hazelnutseedate	Polyglyceryl-6 Tristearate	Polyglyceryl-20 Docosabehenate/Isostearate
Borage Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Isostearate/Laurate	Polyglyceryl-6 Undecylenate	Polyglyceryl-20 Docosabehenate/Laurate
Caprylic/Capric Glycerides Polyglyceryl-10 Esters	Polyglyceryl-4 Laurate/Sebacate	Polyglyceryl-6 Ximenia Americana Seedate	Polyglyceryl-20 Docosabehenate/Oleate
Carapa Guaianensis Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Laurate/Succinate	Polyglyceryl-8 C12-20 Acid Ester	Polyglyceryl-20 Heptacaprylate
Caster Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Pentaoleate	Polyglyceryl-8 Oleate	Polyglyceryl-20 Heptadecabehenate/Laurate
Cocoa Butter Polyglyceryl-6 Esters	Polyglyceryl-4 Pentapalmitate/Stearate	Polyglyceryl-8 Stearate	Polyglyceryl-20 Hexacaprylate
Coffee Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Pentastearate	Polyglyceryl-10 Apricot Kernelate	Polyglyceryl-20 Octadecabehenate/Laurate
Hazelnut Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Punicate	Polyglyceryl-10 Caprate	Polyglyceryl-20 Octaisnonanoate
Linseed Oil Polyglyceryl-4 Esters	Polyglyceryl-4 Stearate	Polyglyceryl-10 Caprylate	Pumpkin Seed Oil Polyglyceryl-4 Esters
Macadamia Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Sweet Almond/ate	Polyglyceryl-10 Caprylate/Caprata	Pumpkin Seed Oil Polyglyceryl-4 Esters Succinate
Mauritia Flexuosa Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-4 Tristearate	Polyglyceryl-10 Cocoate	Rice Bran Oil Polyglyceryl-3 Esters
Olive Oil Polyglyceryl-3 Esters	Polyglyceryl-5 Caprate	Polyglyceryl-10 Decaethylhexanoate	Rosa Rubiginosa Seed Oil Polyglyceryl-6 Esters
Olive Oil Polyglyceryl-4 Esters	Polyglyceryl-5 Dicaprylate	Polyglyceryl-10 Decahydroxystearate	Safflower Seed Oil Polyglyceryl-6 Esters
Olive Oil Polyglyceryl-6 Esters	Polyglyceryl-5 Dilaurate	Polyglyceryl-10 Decalinoleate	Schinzioophyton Rautanenii Kernel Oil Polyglyceryl-6 Esters
Palm Kernel Oil Polyglyceryl-4 Esters	Polyglyceryl-5 Hexastearate	Polyglyceryl-10 Decamacadamiate	Sclerocarya Birrea Seed Oil Polyglyceryl-6 Esters
Palm Oil Polyglyceryl-3 Esters	Polyglyceryl-5 Myristate	Polyglyceryl-10 Decastearate	Sclerocarya Birrea Seed Oil Polyglyceryl-10 Esters
Palm Oil Polyglyceryl-5 Esters	Polyglyceryl-5 Pentamyrystate	Polyglyceryl-10 Dicocoate	Sesame Oil Polyglyceryl-6 Esters
Palm Oil Polyglyceryl-6 Esters	Polyglyceryl-5 Ricinoleate	Polyglyceryl-10 Didecanoate	Shea Butter Polyglyceryl-3 Esters
Parinari Curatellifolia Oil Polyglyceryl-6 Esters	Polyglyceryl-5 Tribehenate	Polyglyceryl-10 Dilaurate	Shea Butter Polyglyceryl-4 Esters
Pinus Sibirica Seed Oil Polyglyceryl-6 Esters	Polyglyceryl-5 Trimyrystate	Polyglyceryl-10 Dimyrystate	Shea Butter Polyglyceryl-6 Esters
Polyglyceryl-2 Caprylate	Polyglyceryl-5 Tristearate	Polyglyceryl-10 Dodecabehenate	Soybean Oil Polyglyceryl-6 Esters
Polyglyceryl-2 Dioleate	Polyglyceryl-6 Adansonia Digitata Seedate	Polyglyceryl-10 Dodecacaprata	Sunflower Seed Oil Polyglyceryl-3 Esters
Polyglyceryl-2 Distearate	Polyglyceryl-6 Apricot Kernelate	Polyglyceryl-10 Dodecacaprylate	Sunflower Seed Oil Polyglyceryl-4 Esters
Polyglyceryl-2 Isopalmitate/Sebacate	Polyglyceryl-6 Argan Kernelate	Polyglyceryl-10 Dodeca-Caprylate/ Caprate	Sunflower Seed Oil Polyglyceryl-5 Esters
Polyglyceryl-2 Myristate	Polyglyceryl-6 Behenate	Polyglyceryl-10 Eicosanedioate/Tetradecanedioate	Sunflower Seed Oil Polyglyceryl-6 Esters
Polyglyceryl-2 Palmitate	Polyglyceryl-6 Caprate	Polyglyceryl-10 Hepta(Behenate/Stearate)	Sunflower Seed Oil Polyglyceryl-10 Esters
Polyglyceryl-2 Sesquicaprylate	Polyglyceryl-6 Caprylate	Polyglyceryl-10 Heptaoleate	Sweet Almond Oil Polyglyceryl-4 Esters
Polyglyceryl-2 Sesquioleate	Polyglyceryl-6 Citrullus Lanatus Seedate	Polyglyceryl-10 Heptastearate	Sweet Almond Oil Polyglyceryl-6 Esters
Polyglyceryl-2 Tetrabehenate/ Macadamiate/Sebacate	Polyglyceryl-6 Dicaprate	Polyglyceryl-10 Hexaerucate	Theobroma Grandiflorum Seed Butter Polyglyceryl-6 Esters
Polyglyceryl-2 Tetraoleate	Polyglyceryl-6 Diisostearate	Polyglyceryl-10 Hexaisostearate	Trichilia Emetica Seed Oil Polyglyceryl-6 Esters
Polyglyceryl-2 Tristearate	Polyglyceryl-6 Dipalmitate	Polyglyceryl-10 Hexaoleate	Watermelon Seed Oil Polyglyceryl-6 Esters
Polyglyceryl-3 Behenate	Polyglyceryl-6 Heptacaprylate	Polyglyceryl-10 Linoleate	Watermelon Seed Oil Polyglyceryl-10 Esters
Polyglyceryl-3 Cocoate	Polyglyceryl-6 Hexaoleate	Polyglyceryl-10 Mono/Dioleate	Ximenia Americana Seed Oil Polyglyceryl-6 Esters
Polyglyceryl-3 Dicaprate	Polyglyceryl-6 Hexastearate	Polyglyceryl-10 Nonaerucate	
Polyglyceryl-3 Dicocoate	Polyglyceryl-6 Laurate	Polyglyceryl-10 Palmate	
Polyglyceryl-3 Di-Hydroxystearate	Polyglyceryl-6 Myristate	Polyglyceryl-10 Palmitate	
Polyglyceryl-3 Dioleate	Polyglyceryl-6 Octacaprylate	Polyglyceryl-10 Pentacaprylate	
Polyglyceryl-3 Myristate	Polyglyceryl-6 Palmitate	Polyglyceryl-10 Pentalaurate	
Polyglyceryl-3 Palmitate	Polyglyceryl-6 Palmitate/Succinate	Polyglyceryl-10 Pentalinoleate	
Polyglyceryl-3 Pentacaprylate/Caprata	Polyglyceryl-6 Pentacaprylate	Polyglyceryl-10 Pentaricinoleate	
Polyglyceryl-3 Pentaolivate	Polyglyceryl-6 Pentaoleate	Polyglyceryl-10 Sesquisteate	

**Table 11. Disposition of radioactivity in rats after a single oral dose**

Catabolism Study <sup>31</sup>						
Test Compound - Ingredients	% radioactivity recovered					
	CO <sub>2</sub>	urine	Feces	GI contents	carcass	
[ <sup>14</sup> C]Polyglyceryl-10 Oleate	2.1	36.8	9.5	46.5	5.3	
[ <sup>14</sup> C]Polyglyceryl-10 Decaoleate	3.5	33.5	15.5	44.6	3.0	
polyglyceryl-3 [ <sup>14</sup> C]oleate	68.2	1.3	0.1	2.8	27.7	
polyglyceryl-10 [ <sup>14</sup> C]oleate	68.5	2.2	0.6	4.0	24.7	
polyglyceryl-10 [ <sup>14</sup> C]decaoleate	66.0	1.7	0.9	2.8	28.7	
<b>For Comparison</b>						
glycerol-1,3- <sup>14</sup> C	73.3	5.2	0.7	1.3	19.5	
[ <sup>14</sup> C]polyglycerin-3	2.1	88.3	5.5	2.9	1.2	
[ <sup>14</sup> C]polyglycerin-10	4.2	34.1	23.9	35.2	2.5	
triglycerol [ <sup>14</sup> C]tetraoleate	70.4	1.4	1.5	3.0	23.6	
polyglycerin-10 [ <sup>14</sup> C]monoeicosanoate	55.5	1.6	9.9	12.2	20.8	
Catabolism- Absorption Study <sup>31</sup>						
Test Compound - Ingredients	% radioactivity recovered					
	CO <sub>2</sub>	urine	feces	GI contents	carcass	lymph
[ <sup>14</sup> C]Polyglyceryl-10 Oleate	1.5	42.4	45.6	3.5	5.1	1.9
[ <sup>14</sup> C]Polyglyceryl-10 Decaoleate	1.7	25.6	60.8	3.1	3.8	5.0
polyglyceryl-3 [ <sup>14</sup> C]oleate	13.7	0.9	3.4	0.4	3.1	78.5
polyglyceryl-10 [ <sup>14</sup> C]oleate	14.4	1.0	6.1	1.6	1.9	75.0
polyglyceryl-10 [ <sup>14</sup> C]decaoleate	13.3	1.4	8.4	2.3	7.1	67.5
<b>For Comparison</b>						
glycerol-1,3- <sup>14</sup> C	73.6	4.8	1.7	0.4	12.7	6.8
[ <sup>14</sup> C]polyglycerin-3	1.7	69.5	20.2	0.6	4.7	3.3
[ <sup>14</sup> C]polyglycerin-10	3.9	45.4	34.0	4.3	11.6	0.8
triglycerol [ <sup>14</sup> C]tetraoleate	12.7	0.9	6.2	1.7	2.6	76.0
polyglycerin-10 [ <sup>14</sup> C]monoeicosanoate	8.9					

### Table 12. Acute Toxicity Studies

[illegible]

Table 13. Genotoxicity studies

Test Article	Concentration/Vehicle	Test System	Procedure	Results	Reference
<b>IN VITRO</b>					
<b>Polyglyceryl Monoesters</b>					
Polyglyceryl-2 Oleate	333-5000 µg/plate in DMSO	<i>S. typhimurium</i> TA1535, TA1537, TA98 and TA100; <i>E. coli</i> WP2uvrA	Ames test, with and without metabolic activation (OECD Guideline 471)	not mutagenic cytotoxic at 5000 µg/plate in strain TA1537 without activation and TA1535 with activation positive and vehicle controls gave expected results	44
Polyglyceryl-2 Oleate	10-150 µg/ml, 4-h exposure with and without activation 5-75 µg/ml, 24-h exposure without activation in DMSO	mouse lymphoma L5178Y cells	mammalian cell gene mutation assay, with and without metabolic activation (OECD test guideline 476)	not genotoxic cytotoxic without activation at ≥30 µg/ml and with activation at ≥50 µg/ml positive and vehicle controls gave expected results	44
Polyglyceryl-2 Oleate	25-150 and 50-200 µg/ml, 4-h exposure without and with activation, respectively; 25-100 µg/ml, 22-h exposure without activation in DMSO	human peripheral blood lymphocytes	chromosomal aberration assay, with and without metabolic activation (OECD Guideline 473)	not genotoxic positive and vehicle controls gave expected results	44
Polyglyceryl-3 Caprate	not provided	not provided	Ames test; OECD 471	not evidence of mutagenic activity	39
Polyglyceryl-3 Caprylate	not provided	not provided	Ames test; OECD 471	not evidence of mutagenic activity	40
Polyglyceryl-3 Laurate	50-5000 µg/plate (vehicle not specified)	not provided	Ames test; details not provided	negative	50
Polyglyceryl-3 Isostearate	not provided	not provided	Ames test; details not provided	not evidence of mutagenic activity	41
Polyglyceryl-4 Caprate	not provided	not provided	Ames test; OECD 471	not evidence of mutagenic activity	43
Polyglyceryl-4 Isostearate	not provided	not provided	Ames test; details not provided	negative	42
Polyglyceryl-4 Laurate/Succinate	1.5-5000 µg/plate in distilled water	<i>S. typhimurium</i> TA1535, TA1537, TA98, TA100; <i>E. coli</i> WP2uvrA	Ames test, with and without metabolic activation	not mutagenic cytotoxicity was observed in <i>S. typhimurium</i> with several concentrations positive and vehicle controls gave expected results	51
Polyglyceryl-6 Caprylate/Caprate	0.15-5000 µg/plate in distilled water	<i>S. typhimurium</i> TA1535, TA1537, TA98, TA100; <i>E. coli</i> WP2uvrA	Ames test, with and without metabolic activation	not mutagenic cytotoxicity was observed with several concentrations positive and vehicle controls gave expected results	52
Polyglyceryl-10 Laurate (~60% pure, with ~40% polyglycerin-10 and ~2% sodium laurate)	0-125 µg/ml without activation 0-2250 µg/ml with activation	Chinese hamster V79 cells	chromosomal aberration assay; 20 h harvest time	equivocal without and positive with activation without activation, a slight increase of aberrant cells was seen with 50 and 70, but not 65, µg/ml with activation, the aberration rates with 1250 and 1500 µg/mL were significantly increased, and a dose relationship was observed	20

**Table 13. Genotoxicity studies**

Test Article	Concentration/Vehicle	Test System	Procedure	Results	Reference
Polyglyceryl-10 Laurate (~60% pure, with ~40% polyglycerin-10 and ~2% sodium laurate)	10-1000 µg/ml, 4-h exposure without and with activation 10-500 µg/ml, 20-h exposure without activation	human peripheral lymphocytes	chromosomal aberration assay; 20 h harvest time metaphase analysis was performed with cultures exposed to 50 - 250 µg/ml for 4 h and 50 - 300 µg/ml for 20 h without metabolic activation, and to 125 -500 µg/ml with metabolic activation	not clastogenic; no significant increases in chromosomal aberrant aberrations were observed in any treatment group at any dose level	<sup>20</sup>
<b>Polyglyceryl Multi-esters</b>					
Polyglyceryl-2 Diisostearate	4-5000µg/plate in acetone	<i>S. typhimurium</i> TA1535, TA1537, TA98, TA100	Ames test, with and without metabolic activation (OECD test guideline 471)	not mutagenic	<sup>33</sup>
Polyglyceryl-2 Diisostearate	3.16 - 5000 µg/ml, 4-h exposure without and with activation 10-5000 µg/ml, 20-h exposure without activation cell culture medium (MEM) served as the vehicle	Chinese hamster lung fibroblasts V79 cells	mammalian cell gene mutation assay, with and without metabolic activation (OECD test guideline 476); 20 h harvest time chromosomal aberrations were evaluated in cultures exposed to 1000-5000 µg/ml for 4 h and 50 - 5000 µg/ml for 20 h without metabolic activation, and to 100 -5000 µg/ml with metabolic activation	no evidence of a concentration-related positive response	<sup>33</sup>
Polyglyceryl-2 Diisostearate	3.16-5000µg/ml in cell culture medium (MEM)	Chinese hamster lung fibroblasts V79 cells	chromosomal aberration assay, with and without metabolic activation (OECD test guideline 473)	not clastogenic	<sup>33</sup>
1,2,3-propanetriol, homopolymer, diisooctadecanoate (n not defined; most likely Polyglyceryl-3 Diisostearate)	8-5000 µg/plate in Tween 80/bidistilled water	<i>S. typhimurium</i> TA1535, TA1537, TA1538, TA98 and TA100	Ames test, with and without metabolic activation (OECD Guideline 471)	not mutagenic positive and vehicle controls gave expected results	<sup>38</sup>
1,2,3-propanetriol, homopolymer, diisooctadecanoate (n not defined; most likely Polyglyceryl-3 Diisostearate)	3.13 - 200 µg/ml, 4-h exposure without activation 3.13 - 150 µg/ml, 4-h exposure with activation in DMSO	CHO cells	mammalian cell gene mutation assay, with and without metabolic activation (OECD test guideline 476); 4-h exposure	not genotoxic positive and negative controls gave expected results	<sup>38</sup>
1,2,3-propanetriol, homopolymer, diisooctadecanoate (n not defined; most likely Polyglyceryl-3 Diisostearate)	12.5-800µg/ml without and 3.13-800µg/ml with activation, in DMSO	Chinese hamster lung fibroblasts V79 cells	chromosomal aberration assay, with and without metabolic activation (OECD test guideline 473); 4 and 18-h exposure	not clastogenic	<sup>38</sup>
Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate	not provided	not provided	Ames test; OECD 471	negative	<sup>46</sup>

Abbreviations: CHO – Chinese hamster ovary; DMSO – dimethyl sulfoxide; MEM – minimum essential medium; OECD – Organisation for Economic Co-operation and Development

Table 14. Dermal irritation and sensitization

Test Article	Concentration/Dose	test system/# per Group	Procedure	Results	Reference
<b>ALTERNATIVE STUDIES</b>					
<b>Polyglyceryl Monoesters</b>					
Apricot Kernel Oil Polyglyceryl-4 Esters	16 ± 0.5 µl	reconstituted human epidermis	SkinEthic™ irritation test; test material was applied for 42 min; cell viability assessment by MTT method after 42 h	classified as non-irritant	48
Palm Oil Polyglyceryl-4 Esters	16 ± 0.5 µl	reconstituted human epidermis	SkinEthic™ irritation test; test material was applied for 42 min; cell viability assessment by MTT method after 42 h	classified as non-irritant	45
Polyglyceryl-4 Laurate/Sebacate	neat	reconstituted human epidermis	EpiSkin™ model; 15 min treatment period with a 42 h post-exposure incubation period; cell viability was measured by MTT reduction	considered to be non-irritant relative mean viability was 105.4%	53
Polyglyceryl-4 Laurate/Succinate	neat	reconstituted human epidermis	EpiSkin™ model; 15 min treatment period with a 42 h post-exposure incubation period; cell viability was measured by MTT reduction	considered to be non-irritant relative mean viability was 104.1%	54
Polyglyceryl-6 Caprylate/Caprate	neat	reconstituted human epidermis	EpiSkin™ model; 15 min treatment period with a 42 h post-exposure incubation period; cell viability was measured by MTT reduction	considered to be non-irritant relative mean viability was 105.7%	55
<b>ANIMAL</b>					
<b>Polyglyceryl Monoesters</b>					
Polyglyceryl-2 Isostearate	undiluted; 0.5 ml	3 NZW rabbits	OECD test guideline 404 4-h, 2 x 3 cm semi-occlusive patch applied to clipped skin	PII of 0.8 (mildly irritating); very slight erythema was observed in all 3 animals and resolved in 2-7 days	56
Polyglyceryl-3 Caprate	not provided	rabbit	OECD 404 (acute dermal irritation/corrosion)	not irritating	39
Polyglyceryl-3 Caprate	not provided	guinea pig	OECD 406 (sensitization)	no skin sensitization effect	39
a polyglyceryl mono/diester of capric acid (C10) (provided as read-across for Polyglyceryl-3 Caprylate)	not provided	rabbit	OECD 404 (acute dermal irritation/corrosion)	not irritating	40
Polyglyceryl-3 Caprylate	not provided	not stated	OECD 429; LLNA	not sensitizing	40
Polyglyceryl-3 Isostearate	not provided	rabbit	FHSA, 16 CFR 1500.41	moderately irritating	41
Polyglyceryl-3 Isostearate	not provided	guinea pig	OECD 406 (sensitization)	no skin sensitization effect	41
Polyglyceryl-3 Oleate	not provided	rabbit	FHSA, 16 CFR 1500.41	moderately irritating	42
Polyglyceryl-4 Caprate	not provided	rabbit	OECD 404 (acute dermal irritation/corrosion)	not irritating	43
Polyglyceryl-4 Caprate	not provided	guinea pig	OECD 406 (sensitization)	no skin sensitization effect	43
Polyglyceryl-4 Isostearate	not provided	guinea pig	OECD 406 (sensitization)	no sensitizing effect	42
<b>Polyglyceryl Multi-Esters</b>					
Polyglyceryl-2 Diisostearate	undiluted; 0.5 ml	3 NZW rabbits	OECD test guideline 404 4-h, 2.5 cm <sup>2</sup> semi-occlusive patch	non-irritating; 1 animal had well-defined erythema 24 h after patch removal	33
Polyglyceryl-2 Diisostearate	1 and 10% in saline, and undiluted; 0.5 ml	2 Albino-Himalayan-Kaninchen rabbits/gp	24-h, 2.5 cm <sup>2</sup> occlusive patch on intact and abraded skin	slightly irritating; with undiluted test substance, distinct erythema and slight to distinct edema was observed in both animals; with 10%, marked erythema was observed in 1 animal for a short time; with 1%, slight erythema in 1 animal	33

**Table 14. Dermal irritation and sensitization**

Test Article	Concentration/Dose	test system/# per Group	Procedure	Results	Reference
Polyglyceryl-2 Diisostearate	induction: 100% challenge: 20% in acetone	20 female Pirbright-White guinea pigs/gp	Buehler test using occlusive patches; 10 control animals were exposed to an ethanol-water (80:20) mixture	non-sensitizing	33
Polyglyceryl-3 Diisostearate	not specified	3 NZW rabbits	method was described as OECD Guideline 404, but study details were not provided; test sites were scored according to Draize	not irritating; slight erythema was seen on skin of all 3 animals tested starting 1 hour following application, and this effect was fully reversible within by 72 h	44,45
Polyglyceryl-3 Diisostearate	5-50% in paraffin perliquid DAB 8	3 Pirbright-White guinea pigs	in a range-finding study for a sensitization test, the test material was applied to the shaved flank for 6 h	not irritating after 24 h	44
1,2,3-propanetriol, homopolymer, diisooctadecanoate (n not defined; most likely Polyglyceryl-3 Diisostearate)	undiluted; 0.5 ml	4 male rabbits	OECD Guideline 404; 4-h occlusive patch to a shaved 6.25 cm <sup>2</sup> area	not irritating; very slight to slight erythema in 3/4 animals at 24 and 48 h; slight and moderate erythema in 2/4 animals at 72 h; the effects were reversible in all animals within 7 d	38
Polyglyceryl-3 Diisostearate	induction: 50% in paraffin perliquid DAB 8 (induction 1) or in petrolatum (inductions 2 and 3) challenge: 50% paraffin perliquid DAB 8 rechallenge: 25%	20 (test) or 19 (control) female Pirbright-White guinea pigs	test sites were pre-treated with 10% SDS in petrolatum, 24 h prior to each induction application <u>epicutaneous induction</u> : 6-h occlusive patches (0.2 ml) applied 1x/wk for 3 wks; half of the controls were pretreated with SDS 24 h prior to application of patches containing vehicle <u>challenge</u> : 6-h occlusive patch (0.1 ml) applied on day 28 <u>rechallenge</u> : 6-h occlusive patch (0.1 ml) applied on day 35	non-sensitizing very slight skin reactions (erythema and edema) were seen at 24-h following the challenge and rechallenge patches in test and control animals; these reactions were reversible in all animals within 48 h and were attributed to irritation	44
Polyglyceryl-3 Diisostearate	induction: 0.1% or 0.2% (intradermal) and 40% (epicutaneous) challenge: 10 and 15% rechallenge: 8 and 4% in paraffin perliquid-DAB 8	20 (test) or 19 (control) female Pirbright-White guinea pigs	GPMT, with FCA; no positive control <u>intradermal induction</u> : 3 pairs of injections on day 1 consisting of (1) 0.1 ml of a 1:1 mixture (v/v) FCA/physiological saline in water); (2) 0.1 ml test 0.1% substance in paraffin perliquid DAB 8; (3) 0.1 ml of a 1:1 mixture (v/v) of 0.2% test substance in paraffin perliquid DAB 8 and 50% FCA in physiological saline <u>epicutaneous induction</u> : 48-h occlusive patch (1 ml) on day 8 <u>challenge</u> : 24-h occlusive patches on day 22 (0.1 ml) <u>rechallenge</u> : 24 h occlusive patches on day 29 (0.1 ml)	results were inconclusive <u>intradermal induction</u> : 0.1 ml FCA (50% (v/v)), the test substance (0.1% (v/v)) and a 1:1 mixture of the test substance with FCA caused moderate to severe skin reactions; in the control group, 0.1 ml of the vehicle resulted in moderate skin reactions <u>epicutaneous induction</u> : after treatment with 40% of the test substance, the injection sites of the intradermal induction were bloody and purulent and at a later stage, this sites showed necrotic and scabby skin lesions <u>challenge with 15%</u> : at 24 h, erythema (1) was observed in 9 test and 2 control animals; edema (2) in 1 test animal, and edema (1) in 2 test and 2 control animals; at 48 h, erythema (2) in 1 test animal (that was 0 at 24 h), erythema (1) in 7 test animals, same edema scores as at 24 h for test animals, no edema in controls <u>challenge with 10%</u> : at 24 h, erythema (3) in 1 and erythema (1) in 5 test animals, edema (3) in 1 and edema (2) in 1 test animal; at 48 h, erythema (3) and edema (3) in 1 animal and erythema (1) and edema (1) in 1 test animal; no erythema or edema in controls at 24 or 48 h <u>rechallenge with 8%</u> : at 24 h, erythema (1) in 6 test and 4 control animals, no edema in test or controls; at 48-h, erythema (1) in 3 test and 1 control animals, no edema in test or controls <u>rechallenge with 4%</u> : no erythema or edema	44



**Table 14. Dermal irritation and sensitization**

Test Article	Concentration/Dose	test system/# per Group	Procedure	Results	Reference
Polyglyceryl-4 Diisostearate/ Polyhydroxystearate/Sebacate (provided as read-across for Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate)	not provided	guinea pig	OECD 406 (sensitization)	not sensitizing	46
<b>HUMAN</b>					
<b>Polyglyceryl Monoesters</b>					
Polyglyceryl-2 Isostearate	7% in ESTOL 1512 (i.e., isopropyl myristate); 0.4 ml	30 subjects	three 24-h occlusive patches, with 24 to 48-h between applications	elicited slight irritation; significantly less irritating than the positive control (0.3% sodium lauryl sulfate) and significantly more irritating than the negative control (deionized water) (p=0.05)	57
Polyglyceryl-3 Laurate	100%; 150 µl/patch	114 subjects	HRIPT	not an irritant or a sensitizer	50
Polyglyceryl-10 Myristate	10%	48 subjects	48-h occlusive patch test	negative	58
Polyglyceryl-10 Stearate	10%	48 subjects	48-h occlusive patch test	non-irritating	59
60% Polyglyceryl-10 Eicosanedi- oate/ Tetradecanedioate/40% gly- cerin mixture	undiluted	45 subjects	closed patch test; details not provided	negative	60
<b>Polyglyceryl Multi-Esters</b>					
Polyglyceryl-2 Sesquiosostearate	undiluted	50 subjects	24-h semi-occlusive patches	not irritating	33
1,2,3-propanetriol, homopolymer, diisooctadecanoate (n not defined; likely Polyglyceryl-3 Diisostearate)	20% “active substance” in “cosmetic alcohol”; 70 µl	20 subjects	24-h occlusive patches	not irritating slight erythema in 3 and slight scaling in 2 subjects	38
Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate	not provided	no provided	occlusive patch test; details not provided	“no concern”	46
Triisostearoyl Polyglyceryl-3 Dimer Dilinoleate	100%; 150 µl/patch	103 subjects	HRIPT	not an irritant or a sensitizer	50
Polyglyceryl-10 Pentaistearate	50%	44 Japanese subjects	24-h occlusive patch	negative	61
Polyglyceryl-10 Decaoleate	neat	44 Japanese subjects	24-h occlusive patch	negative	62

Abbreviations: CFR – Code of Federal Regulations; CPSC – Consumer Product Safety Commission; FCA – Freund’s Complete Adjuvant; FHSA – Federal Hazardous Substances Act; GPMT – guinea pig maximization test; HET-CAM – hen’s egg test chorioallantoic membrane; HRIPT – human repeated insult patch test; LLNA – local lymph node assay; ME – microemulsion; OECD – Organisation for Economic Co-operation and Development; SDS – sodium dodecyl sulfate

Table 15. Ocular irritation studies

Test Article	Concentration/Dose	#/Animals/Grp	Method	Results	Reference
<b>ALTERNATIVE STUDIES</b>					
<b>Polyglyceryl Monoesters</b>					
Polyglyceryl-3 Laurate	10% in corn oil	---	EpiOcular™ tissue model	classified as non-irritating ET <sub>50</sub> was >256 min	63
ME containing 30% Polyglyceryl-4 Laurate	100 µl	6 replicates	HET-CAM assay; the test article also contained 1 or 2% linoleic acid, 4 or 5% isopropyl palmitate, and 65% water-1,2-pentanediol (1:9) or 63 or 65% water-1,2-pentanediol (1.5:8.5)	non-irritant	36
ME containing 40% Polyglyceryl-4 Laurate	100 µl	6 replicates	HET-CAM; this test article also contained 2% linoleic acid, 5% isopropyl palmitate, 53% water-1,2-pentanediol (1:9)	non-irritant	36
Apricot Kernel Oil Polyglyceryl-4 Esters	0.3 g	# of replicates not stated	HET-CAM; CAM was rinsed with 5 ml physiological saline after 240 s of contact	practically non-irritating	45
Palm Oil Polyglyceryl-4 Esters	0.3 g	# of replicates not stated	HET-CAM; CAM was rinsed with 5 ml physiological saline after 240 s of contact	practically non-irritating	45
Polyglyceryl-4 Laurate/Sebacate	30 µl	human corneal epithelial cells	SkinEthic™ reconstituted HCE model; 10 min treatment period, tissues were then rinsed; MTT was used to measure viability	considered to be non-irritant relative mean viability was 85.9%	64
Polyglyceryl-4 Laurate/Succinate	30 µl	human corneal epithelial cells	SkinEthic™ reconstituted HCE model; 10 min treatment period, tissues were then rinsed; MTT was used to measure viability	considered to be non-irritant relative mean viability was 70.0%	65
Polyglyceryl-6 Caprylate/Caprates	30 µl	human corneal epithelial cells	SkinEthic™ reconstituted HCE model; 10 min treatment period, tissues were then rinsed; MTT was used to measure viability	considered to be non-irritant relative mean viability was 88.4%	66
Polyglyceryl-10 Myristate	1000 mg/l (max)	rabbit corneal epithelial cells	SIRC-NR (not defined)	non-irritant	58
Polyglyceryl-10 Stearate	1000 mg/l (max)	rabbit corneal epithelial cells	SIRC-NR (not defined)	non-irritant	59
60% Polyglyceryl-10 Eicosanedioate/ Tetradecanedioate/40% glycerin mixture	undiluted	---	EpiOcular™ test	non-irritant	60
<b>Polyglyceryl Multi-Esters</b>					
Polyglyceryl-2 Dioleate	undiluted; 300 µl	6 eggs	HET-CAM assay	classified as non-irritating Q-score <1.2 (up to 300 s)	44
Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate	not stated	not stated	HET-CAM assay	minor irritation	46
Triisostearoyl Polyglyceryl-3 Dimer Dilinoleate	10% in corn oil	---	EpiOcular™ tissue model	classified as non-irritating ET <sub>50</sub> was >256 min	47
Polyglyceryl-10 Diisostearate	1000 mg/l (max)	rabbit corneal epithelial cells	SIRC-NR (not defined)	non-irritant	67
<b>ANIMAL</b>					
<b>Polyglyceryl Monoesters</b>					
Polyglyceryl-3 Caprate	not provided	rabbits; # not stated	OECD 405 (acute eye irritation/corrosion)	not irritating	39
a polyglyceryl mono/diester of capric acid (C10) (provided as read-across for Polyglyceryl-3 Caprylate)	not provided	rabbits; # not stated	OECD 405 (acute eye irritation/corrosion)	not irritating	40

**Table 15. Ocular irritation studies**

Test Article	Concentration/Dose	#/Animals/Grp	Method	Results	Reference
Polyglyceryl-3 Isostearate	not provided	rabbits; # not stated	FHSA/CPSC 16 CFR 1500.42	mildly irritating	<sup>41</sup>
Polyglyceryl-3 Oleate	not provided	rabbits; # not stated	FHSA/CPSC 16 CFR 1500.42	mildly irritating	<sup>42</sup>
Polyglyceryl-4 Caprate	not provided	rabbits; # not stated	OECD 405 (acute eye irritation/corrosion)	not irritating	<sup>43</sup>
<b>Polyglyceryl Multi-Esters</b>					
Polyglyceryl-2 Diisostearate	undiluted, 0.1 ml	3 NZW rabbits	OECD test guideline 405 eyes were rinsed after 24 h and at all exams	not irritating; some observations were made at 24 h, but were fully reversible at 48 h	<sup>33</sup>
Polyglyceryl-2 Diisostearate	undiluted, 0.1 ml	6 NZW rabbits	rinsing not specified	not a primary eye irritant; at 24 h, 4 animals had injected vessels and 1 had swelling; at 48 h, 2 animals had erythema and 2 had swelling; no effects were seen at 72 h	<sup>33</sup>
Polyglyceryl-2 Diisostearate	0.1 and 10% in saline and undiluted; 0.1 ml	2 Albino-Himalayan-Kaninchen rabbits/gp	eyes were rinsed after 24 h	some ocular effects, including reddening were observed at all concentrations tested, but the results were not quantified	<sup>33</sup>
Polyglyceryl-2 Dioleate	undiluted	3 rabbits	rinsing not specified	not irritating; no signs of irritation were observed	<sup>44</sup>
Polyglyceryl-3 Diisostearate	not stated; assumed to be undiluted	3 New Zealand albino rabbits	OECD test guideline 405	non-irritating; at 1 h in animals, chemosis (score of 1) and redness (score of 2) were reported; at 72 h, chemosis was completely resolved and the redness score was 1	<sup>45</sup>
1,2,3-propanetriol, homopolymer, diisooctadecanoate (n not defined most likely Polyglyceryl-3 Diisostearate)	undiluted; 0.1 ml	4 male Kleinrusse rabbits	eyes were not rinsed	not irritating; at 24 h, very slight redness of the conjunctivae was observed in 1 animal, and the effect was reversible within 48 h	<sup>38</sup>
<b>HUMAN</b>					
<b>Polyglyceryl Monoesters</b>					
Polyglyceryl-10 Laurate (~60% pure, with ~40% polyglycerin-10 and ~2% sodium laurate)	not provided	not provided	not provided	possibly slightly irritating to the eyes	<sup>20</sup>

Abbreviations: HCE – human corneal epithelium; HET-CAM - Hen's Egg Test – Chorioallantoic Membrane; ME – microemulsion; NZW – New Zealand White; OECD – Organisation for Economic Co-operation and Development

## REFERENCES

1. Nikitakis J and Breslawec HP. International Cosmetic Ingredient Dictionary and Handbook. 15 ed. Washington, DC: Personal Care Products Council, 2014.
2. Johnson Jr W, Heldreth B, Bergfeld WF, Belsito DV, Klaassen CD, Hill RA, Liebler DC, Marks Jr JG, Shank RC, Slaga TJ, Snyder PW, and Andersen FA. Final Report of the Cosmetic Ingredient Review Expert Panel on the Safety Assessment of Pelargonic Acid (Nonanoic Acid) and Nonanoate Esters. *Int J Toxicol*. 2011;30(Suppl 3):228S-269S. <http://online.personalcarecouncil.org/ctfa-static/online/lists/cir-pdfs/pr558.pdf>.
3. Fiume MM, Heldreth BA, Bergfeld WF, Belsito DV, Hill RA, Klaassen CD, Liebler DC, Marks Jr JG, Shank RC, Slaga TJ, Snyder PW, and Gill LJ. 2015. Final Amended Report of the Safety Assessment of Monoglyceryl Monoesters as Used in Cosmetics. Available on the Cosmetic Ingredient Review website.
4. European Chemical Agency (ECHA). Information on Chemicals. <http://echa.europa.eu/information-on-chemicals;jsessionid=A978100B4E4CC39C78C93A851EB3E3C7.live1>. Last Updated 2015. Date Accessed 4-23-2015.
5. Norn V. Polyglycerol esters. Emulsifiers Food Technol. 2004. CAPLUS AN 2004:1017707(Conference; General Review).
6. Dürr-Auster N. Doctor of Sciences. Formation and stability of a liquid foam prepared from a lamellar surfactant dispersion. 2008. Switzerland: Swiss Federal Institute of Technology Zurich. ETH Dissertation Number 18045. <http://e-collection.library.ethz.ch/eserv/eth:31101/eth-31101-02.pdf>Date Accessed 4-27-2015
7. Hasenhuettl GL. Synthesis and Commercial Preparation of Food Emulsifiers. Chapter: 2. Hasenhuettl GL and Hartel RW. In: *Food Emulsifiers and Their Applications*. New York: Springer; 2008:11-37.
8. Food and Agriculture Organization (FAO) of the United Nations. Polyglycerol Esters of Fatty Acids. <http://www.fao.org/ag/agn/jecfa-additives/specs/Monograph1/Additive-317.pdf>. Last Updated 2006. Date Accessed 4-20-2015.
9. Food and Drug Administration (FDA). Frequency of use of cosmetic ingredients. *FDA Database*. 2015.
10. Personal Care Products Council. 4-29-2014. Concentration of Use by FDA Product Category: Glyceryl Monoesters. Unpublished data submitted by Personal Care Products Council.
11. Personal Care Products Council. 1-6-2015. Concentration of Use by FDA Product Category: Polyglyceryl Esters. Unpublished data submitted by Personal Care Products Council. 1 pages.
12. Personal Care Products Council. 4-10-2015. Concentration of Use by FDA Product Category: Polyglyceryl Compounds included in the February 2015 Survey. Unpublished data submitted by Personal Care Products Council.
13. Personal Care Products Council. 2015. Concentration of use information: polyglyceryl-10 hydroxystearate/stearate/eicosodioate. Unpublished data submitted by the Personal Care Products Council.
14. Personal Care Products Council. 7-6-2015. Concentration of Use by FDA Product Category: Caprylic/Capric Glycerides Polyglyceryl-10 Esters and Pumpkin Seed Oil Polyglyceryl-4 Esters Succinate. Unpublished data submitted by Personal Care Products Council.
15. Johnsen MA. The influence of particle size. *Spray Technology and Marketing*. 2004;14(11):24-27.
16. Rothe H. Special Aspects of Cosmetic Spray Evaluation. 9-26-2011. Unpublished data presented at the 26 September CIR Expert Panel meeting. Washington, D.C.
17. Bremmer HJ, Prud'homme de Lodder LCH, and Engelen JGM. Cosmetics Fact Sheet: To assess the risks for the consumer; Updated version for ConsExpo 4. 2006. Report No. RIVM 320104001/2006. pp. 1-77.
18. Rothe H, Fautz R, Gerber E, Neumann L, Rettinger K, Schuh W, and Gronewold C. Special aspects of cosmetic spray safety evaluations: Principles on inhalation risk assessment. *Toxicol Lett*. 2011;205(2):97-104.

19. European Commission. CosIng database; following Cosmetic Regulation No. 1223/2009. <http://ec.europa.eu/consumers/cosmetics/cosing/>. Last Updated 2015. Date Accessed 2-27-2015.
20. National Industrial Chemicals Notification and Assessment Scheme (NICNAS). File No. STD/1453. Public report: 1,2,3-Propanetriol, homopolymer, dodecanoate (CAS No. 74504-64-6). 2013. [www.nicnas.gov.au/data/assets/word\\_doc/0003/6096/STD1453-FR-FINAL.docx](http://www.nicnas.gov.au/data/assets/word_doc/0003/6096/STD1453-FR-FINAL.docx). Date Accessed 4-23-2015. Report No. File No: STD/1453.
21. World Health Organization (WHO). Evaluation of certain food additives and contaminants. Thirty-fifth report of the Joint FAO/WHO Expert Committee on Food Additives. WHO Technical Report Series (TRS) 789. [http://whqlibdoc.who.int/trs/WHO\\_TRS\\_789.pdf](http://whqlibdoc.who.int/trs/WHO_TRS_789.pdf). Last Updated 1990. Date Accessed 4-20-2015.
22. Food and Agriculture Organization (FAO) of the United Nations. Polyglycerol esters of interesterified ricinoleic acid. <http://www.fao.org/ag/agn/jecfa-additives/specs/Monograph1/Additive-318.pdf>. Last Updated 2000. Date Accessed 9-17-2015.
23. European Food Safety Authority (EFSA) Panel on Food Contact Materials, Enzymes, Flavourings and Processing Aids (CEF Panel). Scientific Opinion on the safety assessment of the substance, polyglycerol, CAS No 25618-55-7, for use in food contact materials. *EFSA Journal*. 2015;11(10):3389-3396. <http://www.efsa.europa.eu/en/efsajournal/doc/3389.pdf>.
24. Lonza. Product data sheet: Polyaldo 10-1 CC KFG (Polyglyceryl-10 Caprylate/Caprates). [http://bio.lonza.com/uploads/tx\\_mwaxmarketingmaterial/Lonza\\_ProductDataSheets\\_Polyaldo\\_10-1-CC\\_KFG\\_NON\\_GMO\\_PDS.pdf](http://bio.lonza.com/uploads/tx_mwaxmarketingmaterial/Lonza_ProductDataSheets_Polyaldo_10-1-CC_KFG_NON_GMO_PDS.pdf). Last Updated 2010. Date Accessed 3-23-2015.
25. ChemicalBook. Polyglyceryl-10 Oleate. [http://www.chemicalbook.com/ChemicalProductProperty\\_EN\\_CB2966106.htm](http://www.chemicalbook.com/ChemicalProductProperty_EN_CB2966106.htm). Last Updated 2010. Date Accessed 10-30-2015.
26. Gattefossé. Plurol® Oleique CC 497 (Polyglyceryl-3 Dioleate). <http://www.gattefosse.com/en/applications/plurol-oleique-cc497.html>. Last Updated 2010. Date Accessed 12-1-2015.
27. World Health Organization (WHO). Toxicological evaluation of some antimicrobials, antioxidants, emulsifiers, stabilizers, flour-treatment agents, acids and bases. Polyglycerol esters of fatty acids. 1967. <http://www.inchem.org/documents/jecfa/jecmono/40abcj26.htm>. Date Accessed 4-20-2015. Report No. Report Series No. 40A, B, C; WHO/Food Add./67.29.
28. Bodansky M, Herrmann CL, and Campbell K. CCXLIX. Utilization of polyglycerol esters. *Biochem J*. 1938;32(11):1938-1942.
29. Babayan VK, Kaunitz H, and Slanetz CA. Nutritional studies of polyglycerol esters. *Journal of the American Oil Chemists' Society*. 1964;41(6):434-437.
30. World Health Organization (WHO). Toxicological evaluation of some food additives including anticaking agents, antimicrobials, antioxidants, emulsifiers and thickening agents. Polyglycerol esters of fatty acids. 1974. <http://www.inchem.org/documents/jecfa/jecmono/v05je45.htm>. Date Accessed 4-20-2015. Report No. WHO Food Additives Series No. 5.
31. Michael WR and Coots RH. Metabolism of polyglycerol and polyglycerol esters. *Toxicol Appl Pharmacol*. 1971;20(3):334-345.
32. King WR, Michael WR, and Coots RH. Subacute oral toxicity of polyglycerol ester. *Toxicol Appl Pharmacol*. 1971;20(3):327-333.
33. European Chemicals Agency (ECHA). Di(isooctadecanoic) acid, diester with oxydi(propanediol) (CAS No. 67938-21-0). <http://echa.europa.eu/en/registration-dossier/-/registered-dossier/12200>. Last Updated 4-13-2015. Date Accessed 6-5-2015.
34. Cornwell PA, Tubek J, van Gompel HAHP, Little CJ, and Wiechers JW. Glyceryl monocaprylate/caprates as a moderate skin penetration enhancer. *International Journal of Pharmaceutics*. 1998;171(2):243-255.
35. Sahle FF, Metz H, Wohrlab J, and Neubert RH. Polyglycerol fatty acid ester surfactant-based microemulsions for targeted delivery of ceramide AP into the stratum corneum: formulation, characterisation, in vitro release and penetration investigation. *Eur J Pharm Biopharm*. 2012;82(1):139-150.
36. Sahle FF, Wohrlab J, and Neubert RH. Controlled penetration of ceramides into and across the stratum corneum using various types of microemulsions and formulation associated toxicity studies. *Eur J Pharm Biopharm*. 2014;86(2):244-250.

37. Endo M, Yamamoto T, and Ijuin T. Effect of nonionic surfactants on the percutaneous absorption tenoxicam. *Chem Pharm Bull (Tokyo)*. 1996;44(4):865-867.
38. European Chemicals Agency (ECHA). 1,2,3-Propanetriol, homopolymer, diisooctadecanoate (CAS No. 63705-03-3). <http://echa.europa.eu/registration-dossier/-/registered-dossier/11209>. Last Updated 2014. Date Accessed 4-23-2015.
39. Anonymous. 2016. Polyglyceryl-3 Caprate: Summary of product data with reference to toxicology. Unpublished data submitted by Personal Care Products Council.
40. Anonymous. 2016. Polyglyceryl-3 Caprylate: Summary of product data with reference to toxicology. Unpublished data submitted by Personal Care Products Council.
41. Anonymous. 2016. Polyglyceryl-3 Isostearate: Summary of product data with reference to toxicology. Unpublished data submitted by Personal Care Products Council.
42. Anonymous. 2016. Polyglyceryl-3 Oleate: Summary of product data with reference to toxicology. Unpublished data submitted by Personal Care Products Council.
43. Anonymous. 2016. Polyglyceryl-4 Caprate: Summary of product data with reference to toxicology. Unpublished data submitted by Personal Care Products Council.
44. European Chemicals Agency (ECHA). Oleic acid, monoester with oxybis(propanediol) (CAS No. 49553-76-6). <http://echa.europa.eu/registration-dossier/-/registered-dossier/12212>. Last Updated 2013. Date Accessed 4-21-2015.
45. Anonymous. 2016. Summary information Palm Oil Polyglyceryl-4 Esters, Apricot Kernel Oil Polyglyceryl-4 Esters and Polyglyceryl-3 Diisostearate. Unpublished data submitted by Personal Care Products Council.
46. Anonymous. 2016. Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate: Summary of product data with reference to toxicology. Unpublished data submitted by Personal Care Products Council.
47. Lubrizol. Toxicology & Microbiology Studies (TOX-104): Schercemol™ PTID Ester (Triisostearoyl Polyglyceryl-3 Dimer Dilinoleate). <https://www.lubrizol.com/Personal-Care/Documents/Toxicological-and-Microbiological-Studies/TOX-104-Schercemol%E2%84%A2-PTID-Ester.pdf>. Last Updated 2007. Date Accessed 3-11-2015.
48. Lubrizol Advanced Materials. 2007. Schercemol™ PDD Ester (Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate) toxicology studies. Unpublished data submitted by Personal Care Products Council.
49. Baichwal MR and Lalla JK. Polyglycerol esters. III. Stability, toxicity, and compatibility of polyglycerol stearate with pharmaceutical adjuvants. *Indian Journal of Pharmacy*. 1973;35(5):140-145.
50. Lubrizol Advanced Materials. 2016. Summary information polyglyceryl fatty acid esters. Unpublished data submitted by Personal Care Products Council.
51. Harlan Laboratories, Ltd. 2010. Summary: Reverse mutation assay "Ames test" using *Salmonella typhimurium* and *Escherichia coli* (Polyglyceryl-4 Laurate/Succinate). Project No. 4100/3617. Unpublished data submitted by Personal Care Products Council.
52. Harlan Laboratories, Ltd. 2010. Summary: Reverse mutation assay "Ames test" using *Salmonella typhimurium* and *Escherichia coli* (Polyglyceryl-6 Caprylate/Caprate). Project No. 41003618. Unpublished data submitted by Personal Care Products Council.
53. Harlan Laboratories, Ltd. Summary: Determination of skin irritation potential using the Episkin™ reconstituted human epidermis model (Polyglyceryl-4 Laurate/Sebacate). Project No. 2724/0056. 2010. Unpublished data submitted by Personal Care Products Council.
54. Harlan Laboratories, Ltd. 2010. Summary: Determination of skin irritation potential using the Episkin™ reconstituted human epidermis model (Polyglyceryl-4 Laurate/Succinate). Project No. 2724/0055. Unpublished data submitted by Personal Care Products Council.

55. Harlan Laboratories, Ltd. 2010. Summary: Determination of skin irritation potential using the Episkin™ reconstituted human epidermis model (Polyglyceryl-6 Caprylate/Caprates). Project No. 2724/0057. Unpublished data submitted by Personal Care Products Council.
56. Notox BV. Primary skin irritation/corrosion study with Polyglyceryl-2 Isostearate in the rabbit. 1996. Report No. NOTOX Project 167996. Unpublished data submitted by Personal Care Products Council.
57. Globecrown Services Ltd. A three-application patch trial in healthy volunteers to investigate the skin irritation potential of Polyglyceryl-2 Isostearate following cutaneous patch applications. Globecrown Report No. 97/UNCPAT6. 1997. Unpublished data submitted by Personal Care Products Council.
58. Nikko Chemicals Co. Ltd. 2016. Safety information NIKKOL Decaglyn 1-M (Polyglyceryl-10 Myristate). Unpublished data submitted by Personal Care Products Council.
59. Nikko Chemicals Co. Ltd. 2016. Safety information NIKKOL Decaglyn 1-SV (Polyglyceryl-10 Stearate). Unpublished data submitted by Personal Care Products Council.
60. Anonymous. 2009. Material safety data sheet on a trade name mixture containing 60% Polyglyceryl-10 Eicosanedioate/Tetradecanedioate. Unpublished data submitted by Personal Care Products Council.
61. Nikko Chemicals Co. Ltd. 2016. Safety information NIKKOL Decaglyn 5-IS (Polyglyceryl-10 Pentaisostearate). Unpublished data submitted by Personal Care Products Council.
62. Nikko Chemicals Co. Ltd. 2016. Safety information NIKKOL Decaglyn 10-O (Polyglyceryl-10 Decaoleate). Unpublished data submitted by Personal Care Products Council.
63. Lubrizol. Toxicology studies (TOX-094): Hydramol™ TGL Ester (Polyglyceryl-3 Laurate). <https://www.lubrizol.com/Personal-Care/Documents/Toxicological-and-Microbiological-Studies/TOX-094-Hydramol%E2%84%A2-TGL-Ester.pdf>. Last Updated 2007. Date Accessed 3-31-2015.
64. Harlan Laboratories, Ltd. 2010. Summary: Assessment of ocular irritation potential using the Skinethic™ reconstituted human corneal epithelium model (Polyglyceryl-4 Laurate/Sebacate). Project No. 2724/0059. Unpublished data submitted by Personal Care Products Council.
65. Harlan Laboratories, Ltd. 2010. Summary: Assessment of ocular irritation potential using the Skinethic™ reconstituted human corneal epithelium model (Polyglyceryl-4 Laurate/Succinate). Project No. 2724/0058. Unpublished data submitted by Personal Care Products Council.
66. Harlan Laboratories, Ltd. 2010. Summary: Assessment of ocular irritation potential using the Skinethic reconstituted human corneal epithelium model. Project no. 2724/0060. Unpublished data submitted by Personal Care Products Council.
67. Nikko Chemicals Co. Ltd. 2016. Safety information NIKKOL Decaglyn 2-ISV (Polyglyceryl-10 Diisostearate). Unpublished data submitted by Personal Care Products Council.
68. Washizaki K, Kanto H, Yazaki S, and Ito M. A case of allergic contact dermatitis to polyglyceryl laurate. *Contact Dermatitis*. 2008;58(3):187-188.
69. Becker LC, Bergfeld WF, Belsito DV, Hill RA, Klaassen CD, Liebler DC, Marks JG Jr, Shank RC, Slaga TJ, Snyder PW, and Gill LJ. Safety assessment of glycerin as used in cosmetics. 2015. <http://www.cir-safety.org/ingredients>. Date Accessed 8-23-2015. Available on the CIR website.
70. Elder RL (ed). Final Report on the Safety Assessment of Butylene Glycol, Hexylene Glycol, Ethoxydiglycol, and Dipropylene Glycol. *J Am Coll Toxicol*. 1985;4(5):223-248.
71. Andersen FA (ed). Annual Review of Cosmetic Ingredient Safety Assessments - 2004/2005. *Int J Toxicol*. 2006;25(Suppl 2):10-18.
72. Fiume MM, Heldreth BA, Bergfeld WF, Belsito DV, Hill RA, Klaassen CD, Liebler DC, Marks JG Jr, Shank RC, Slaga TJ, Snyder PW, and Andersen FA. Safety Assessment of Propylene Glycol, Tripropylene Glycol, and PPGs as Used in Cosmetics. *Int J Toxicol*. 2012;31(Suppl 2):245S-260S.



73. Johnson WJ Jr, Heldreth BA, Bergfeld WF, Belsito DV, Hill RA, Klaassen CD, Liebler DC, Marks JG Jr, Shank RC, Slaga TJ, Snyder PW, and Gill LJ. 2015. Final Report on the Safety Assessment of Polysaccharide Gums as Used in Cosmetics. Available on the CIR website.
74. Becker LC, Bergfeld WF, Belsito DV, Hill RA, Klaassen CD, Marks JG Jr, Shank RC, Slaga TJ, Snyder PW, and Andersen FA. Final Report on the Amended Safety Assessment of Myristic Acid and Its Salts and Esters as Used in Cosmetics. *Int J Toxicol.* 2010;29(Suppl 3):162S-186S.
75. Fiume MM, Heldreth BA, Bergfeld WF, Belsito DV, Hill RA, Klaassen CD, Liebler DC, Marks JG Jr, Shank RC, Slaga TJ, Snyder PW, and Andersen FA. Safety assessment of citric acid, inorganic citrate salts, and alkyl citrate esters as used in cosmetics. *Int J Toxicol.* 2014;33(Suppl 2):16S-46S. <http://www.cir-safety.org/ingredients>.
76. Burnett CL, Bergfeld WF, Belsito DV, Klaassen CD, Marks JG Jr, Shank RC, Slaga TJ, Snyder PW, and Andersen FA. Final report on the safety assessment of *Cocos nucifera* (coconut) oil and related ingredients. *Int J Toxicol.* 2011;30(Suppl 1):5S-16S. <http://www.cir-safety.org/ingredients>.
77. Andersen FA (ed). Amended final report on the safety assessment of hydroxystearic acid. *Int J Toxicol.* 1999;18(Suppl 1):1-10. <http://www.cir-safety.org/ingredients>.
78. Elder RL (ed). Final report on the safety assessment of isostearic acid. *J Am Coll Toxicol.* 1983;2(7):61-74. <http://www.cir-safety.org/ingredients>.
79. Elder RL (ed). Final report on the safety assessment of oleic acid, lauric acid, palmitic acid, myristic acid, and stearic acid. *J Am Coll Toxicol.* 1987;6(3):321-401. <http://www.cir-safety.org/ingredients>.
80. Burnett CL, Fiume MM, Bergfeld WF, Belsito DV, Hill RA, Klaassen CD, Liebler DC, Marks JG Jr, Shank RC, Slaga TJ, Snyder PW, and Andersen FA. 2011. Final report on the safety assessment of plant-derived fatty acid oils as used in cosmetics. Available on the CIR website.
81. Andersen FA (ed). Final Report on the Safety Assessment of Ricinus Communis (Castor) Seed Oil, Hydrogenated Castor Oil, Glyceryl Ricinoleate, Glyceryl Ricinoleate SE, Ricinoleic Acid, Potassium Ricinoleate, Sodium Ricinoleate, Zinc Ricinoleate, Cetyl Ricinoleate, Ethyl Ricinoleate, Glycol Ricinoleate, Isopropyl Ricinoleate, Methyl Ricinoleate, and Octyldodecyl Ricinoleate. *Int J Toxicol.* 2007;26(Suppl 3):31-77. <http://www.cir-safety.org/ingredients>.
82. Fiume MM, Heldreth BA, Bergfeld WF, Belsito DV, Hill RA, Klaassen CD, Liebler DC, Marks JG Jr, Shank RC, Slaga TJ, Snyder PW, and Andersen FA. Final report of the Cosmetic Ingredient Review Expert Panel on the safety assessment of dicarboxylic acids, salts, and esters. *Int J Toxicol.* 2012;31(Suppl 1):5S-76S. <http://www.cir-safety.org/ingredients>.
83. Elder RL (ed). Final Report of the Safety Assessment of Lithium Stearate, Aluminum Distearate, Aluminum Stearate, Aluminum Tristearate, Ammonium Stearate, Calcium Stearate, Magnesium Stearate, Potassium Stearate, Sodium Stearate, and Zinc Stearate. *J Am Coll Toxicol.* 2016;1(2):143-177.
84. Andersen FA (ed). Annual Review of Cosmetic Ingredient Safety Assessments - 2001/2002. *Int J Toxicol.* 2003;22(Suppl 1):19-28.
85. Elder RL (ed). Final Report on the safety assessment of Candelilla Wax, Carnauba Wax, Japan Wax, and Beeswax. *J Am Coll Toxicol.* 1984;3(3):1-41.
86. Andersen FA (ed). Annual Review of Cosmetic Ingredient Safety Assessments - 2002/2003. *Int J Toxicol.* 2005;24(Suppl 1):48-52.
87. Andersen FA (ed). Amended Final Report on the Safety Assessment of Oryza Sativa (Rice) Bran Oil, Oryza Sativa (Rice) Germ Oil, Rice Bran Acid, Oryza Sativa (Rice) Bran Wax, Hydrogenated Rice Bran Wax, Oryza Sativa (Rice) Bran Extract, Oryza Sativa (Rice) Extract, Oryza Sativa (Rice) Germ Powder, Oryza Sativa (Rice) Starch, Oryza Sativa (Rice) Bran, Hydrolyzed Rice Bran Extract, Hydrolyzed Rice Bran Protein, Hydrolyzed Rice Extract, and Hydrolyzed Rice Protein. *Int J Toxicol.* 2006;25(Suppl 2):91-120.
88. Becker LC, Bergfeld WF, Belsito DV, Klaassen CD, Marks JG Jr, Shank RC, Slaga TJ, Snyder PW, and Andersen FA. 2008. Safety Assessment of Simmondsia Chinensis (Jojoba) Seed Oil, Simmondsia Chinensis (Jojoba) Seed Wax, Hydrogenated Jojoba Oil, Hydrolyzed Jojoba Esters, Isomerized Jojoba Oil, Jojoba Esters, Simmondsia Chinensis (Jojoba) Butter, Jojoba Alcohol, and Synthetic Jojoba Oil. Available on the Cosmetic Ingredient Review website.



89. Aldivia. Technical Data Sheet: VIATENZA® Baobab PO6 (Adansonia Digitata Seed Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/06/TDS-Viatenza%C2%AE-Baobab-PO6-Amphiphilic-200608.pdf>. Last Updated 2008. Date Accessed 2-27-2015.
90. Aldivia. Data sheet: VIATENZA® Apricot PO6 (Apricot Kernel Oil Polyglyceryl-6 Esters ). <http://glenncorp.com/wp-content/uploads/2014/06/TDS-Viatenza-Apricot-PO6-Amphiphile-V9-05-03-2013.pdf>. Last Updated 2013. Date Accessed 4-10-2015.
91. Aldivia. Data Sheet: VIATENZA® Apricot PO10 (Apricot Kernel Oil Polyglyceryl-10 Esters). <http://glenncorp.com/wp-content/uploads/2014/06/TDS-Viatenza%C2%AE-Apricot-PO10-Amphiphilic-160608.pdf>. Last Updated 2008. Date Accessed 3-3-2015.
92. Aldivia. Technical Data Sheet: VIATENZA® Argan PO6 (Argan Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/06/Viatenza%C2%AE-Argan-PO6-Amphiphilic.-TDS.-05.03.13.pdf>. Last Updated 2013. Date Accessed 3-3-2015.
93. Aldivia. Technical Data Sheet: VIATENZA® Babassu PO6 (Babassu Oil Polyglyceryl-6 Esters). [http://glenncorp.com/wp-content/uploads/2014/06/Glenn.TDS\\_Viatenza-Babassu-PO6-Amphiphilic.05.03.13.pdf](http://glenncorp.com/wp-content/uploads/2014/06/Glenn.TDS_Viatenza-Babassu-PO6-Amphiphilic.05.03.13.pdf). Last Updated 2013. Date Accessed 3-3-2015.
94. Aldivia. Technical data sheet: VIATENZA® Brazil Nut PO6 (Bertholletia Excelsa Seed Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/07/TDS-Viatenza-Brazil-Nut-PO6-Amphiphilic-V7-05-03-2013.pdf>. Last Updated 2012. Date Accessed 3-3-2015.
95. Aldivia. Data Sheet: VIATENZA® Caprylic/Capric PO10 (Caprylic/Capric Glycerides Polyglycerin-10 Esters). [http://glenncorp.com/wp-content/uploads/2014/06/Viatenza-Caprylic-Capric-PO10.TDS\\_.06.16.08.pdf](http://glenncorp.com/wp-content/uploads/2014/06/Viatenza-Caprylic-Capric-PO10.TDS_.06.16.08.pdf). Last Updated 2008. Date Accessed 4-14-2015.
96. Abitec. Technical Data Sheet: VIATENZA® Cocoa PO6 (Cocoa butter Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/07/TDS-Viatenza-Cocoa-PO6-Amphiphilic-V7-05-03-2013.pdf>. Last Updated 2013. Date Accessed 3-3-2015.
97. Aldivia. Technical Data Sheet: VIATENZA® Coco PO6 (Coconut Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/07/TDS-Viatenza-Coco-PO6-Amphiphilic-V5-05-03-2013.pdf>. Last Updated 2013. Date Accessed 3-3-2015.
98. Aldivia. Technical data sheet: VIATENZA® Hazel PO6 (Hazel Seed Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/07/TDS-Viatenza%C2%AE-Hazel-PO6-Amphiphilic-2006081.pdf>. Last Updated 2008. Date Accessed 3-4-2015.
99. Aldivia. Technical data sheet: VIATENZA® Macadamia PO6 (Macadamia Seed Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/07/TDS-Viatenza%C2%AE-Macadamia-PO6-Amphiphilic-29112010.pdf>. Last Updated 2010. Date Accessed 3-4-2015.
100. Aldivia. Technical data sheet: VIATENZA® Olive PO6 (Olive Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/06/Viatenza-Olive-PO6-Amphiphilic.-TDS.-05.03.13.pdf>. Last Updated 2013. Date Accessed 3-4-2015.
101. Aldivia. Technical data sheet: VIATENZA® Safflower PO6 (Safflower Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/06/Viatenza%C2%AE-Safflower-PO6-Cx-Amphiphilic.-TDS.-06.16.08.pdf>. Last Updated 2008. Date Accessed 3-5-2015.
102. Aldivia. Technical data sheet: VIATENZA® Mongongo PO6 (Schinziophyton Rautanenii Kernel Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/06/Viatenza%C2%AE-Mongongo-PO6-Amphiphilic.-TDS.-07.15.08.pdf>. Last Updated 2008. Date Accessed 3-5-2015.
103. Aldivia. Technical data sheet: VIATENZA® Marula PO6 (Sclerocarya Birrea Seed Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/07/TDS-Viatenza%C2%AE-Marula-PO6-Amphiphilic-130608.pdf>. Last Updated 2008. Date Accessed 3-5-2015.
104. Aldivia. Technical data sheet: VIATENZA® Sesame PO6 (Sesame Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/07/TDS-Viatenza%C2%AE-Sesame-PO6-Amphiphilic-160608.pdf>. Last Updated 2008. Date Accessed 3-5-2015.

105. Aldivia. Technical data sheet: VIATENZA<sup>®</sup> Shea PO6 (Shea Butter Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/07/TDS-Viatenza%C2%AE-Shea-PO6-Amphiphilic-V7-05-03-2013.pdf>. Last Updated 2013. Date Accessed 3-9-2015.
106. Aldivia. Technical data sheet: VIATENZA<sup>®</sup> Soybean P06 (Soybean Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/07/TDS-Viatenza%C2%AE-Soybean-PO6-Amphiphilic-160608.pdf>. Last Updated 2008. Date Accessed 3-9-2015.
107. Aldivia. Technical data sheet: VIATENZA<sup>®</sup> Oleic Sunflower PO6 (Sunflower Seed Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/06/TDS-Viatenza-Oleic-Sunflower-PO6-Amphiphilic-V3-26-12-2012.pdf>. Last Updated 2012. Date Accessed 3-5-2015.
108. Aldivia. Technical data sheet: VIATENZA<sup>®</sup> Oleic Sunflower PO10 (Sunflower Seed Oil Polyglyceryl-10 Esters). [http://glenncorp.com/wp-content/uploads/2014/06/Viatenza-Oleic-Sunflower-PO10.TDS\\_10.06.08.pdf](http://glenncorp.com/wp-content/uploads/2014/06/Viatenza-Oleic-Sunflower-PO10.TDS_10.06.08.pdf). Last Updated 2008. Date Accessed 3-9-2015.
109. Aldivia. Technical data sheet: VIATENZA<sup>®</sup> Almond PO6 (Sweet Almond Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/07/TDS-Viatenza-Almond-PO6-Amphiphilic-V9-05-03-2013.pdf>. Last Updated 2013. Date Accessed 3-10-2015.
110. Aldivia. Technical data sheet: VIATENZA<sup>®</sup> Mafura PO6 (Trichilia Emetica Seed Oil Polyglyceryl-6 Esters). <http://glenncorp.com/wp-content/uploads/2014/07/TDS-Viatenza%C2%AE-Mafura-PO6-Amphiphilic-160608.pdf>. Last Updated 2008. Date Accessed 3-10-2015.
111. AVG Pharma. PO6 Viatenza<sup>®</sup> Borage (Borage Seed Oil Polyglyceryl-6 Esters). <http://www.avgpharma.it/Attivo.aspx?ActiveID=106&FunctionID=26&ProductID=228&CategoryID=61>. Last Updated 2015. Date Accessed 3-3-2015.
112. Lubrizol. Technical data sheet (TDS-399): Schercemol<sup>™</sup> PDD Ester (Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate). <https://www.lubrizol.com/Personal-Care/Documents/Technical-Data-Sheets/TDS-399-Schercemol%E2%84%A2-PDD-Ester.pdf>. Last Updated 2009.
113. Evonik Industries. Technical Data Sheet: Isolan<sup>®</sup> PDI (Diisostearoyl Polyglyceryl-3 Dimer Dilinoleate). [http://glenn.wpengine.com/wp-content/uploads/2013/11/DS\\_ISOLAN\\_PDI.pdf](http://glenn.wpengine.com/wp-content/uploads/2013/11/DS_ISOLAN_PDI.pdf). Last Updated 2013. Date Accessed 4-10-2015.
114. Stephenson Personal Care. Durosoft. <http://www.stephensonpersonalcare.com/products/durosoft/>. Last Updated 2015. Date Accessed 3-4-2015.
115. Koster Keunen. Technical data sheet: Cera Bellina (Polyglyceryl-3 Beeswax). [http://www.brenntagsspecialties.com/en/downloads/Products/Personal\\_care/Koster\\_Keunen/Cera\\_Bellina\\_106\\_TDS.pdf](http://www.brenntagsspecialties.com/en/downloads/Products/Personal_care/Koster_Keunen/Cera_Bellina_106_TDS.pdf). Last Updated 2015. Date Accessed 4-14-2015.
116. ChemNet. 156153-06-9; Polyglyceryl-2 Caprate. <http://www.chemnet.com/cas/en/156153-06-9/POLYGLYCERYL-2-CAPRATE.html>. Last Updated 2015. Date Accessed 9-14-2015.
117. Evonik Industries. TEGO<sup>®</sup> Cosmo P 813 (Polyglyceryl-3 Caprylate). [http://www.finecon.sk/admin/pdf/DS\\_TEGO\\_Cosmo\\_P\\_813\\_e.pdf](http://www.finecon.sk/admin/pdf/DS_TEGO_Cosmo_P_813_e.pdf). Last Updated 2008. Date Accessed 4-10-2015.
118. Lonza. Product information: Polyaldo<sup>™</sup> 10-1-CC KFG (Polyglyceryl-10 Caprylate/Caprate) [pamphlet]. 2014.
119. Nikko Chemicals co., Ltd. Material Safety Data Sheet: NIKKOL Decaglyn 10-ISV (Polyglyceryl-10 Decaistearate). <http://www.barnetproducts.com/pdfs/msds/DEC10-ISV.pdf>. Last Updated 2004. Date Accessed 4-14-2015.
120. AIC. Specification Sheet: Polyglyceryl-4 Caprate (SOLDOP PG 410<sup>®</sup>). <http://www.aicma.com/products/Polyglyceryl-4%20Caprate%20Soldop%20PG%20410%20PG410L.pdf>. Last Updated 2014. Date Accessed 9-17-2015.
121. Evonik Industries. TEGOSOFT<sup>®</sup> PC 41 (Polyglyceryl-4 Caprate). [http://glenn.wpengine.com/wp-content/uploads/2013/11/DS\\_TEGOSOFT\\_PC41\\_e.pdf](http://glenn.wpengine.com/wp-content/uploads/2013/11/DS_TEGOSOFT_PC41_e.pdf). Last Updated 2013. Date Accessed 9-18-2015.

122. Nihoh Emulsion Co., Ltd. Product information: Emalex DISG-6 (Polyglyceryl-6 Diisostearate). <https://www.nihon-emulsion.co.jp/products/detail/EMALEX%20DISG-6>. Last Updated 2015. Date Accessed 12-3-2015.
123. United States Pharmacopeial Convention. Material Safety Data Sheet: Polyglyceryl-3 Dioleate. <http://static.usp.org/pdf/EN/referenceStandards/msds/1546933.pdf>. Last Updated 2010. Date Accessed 12-1-2015.
124. Sigma-Aldrich. Polyglyceryl-6 Dioleate. <http://www.sigmaaldrich.com/catalog/search?term=76009-37-5&interface=CAS%20No.&N=0+&mode=partialmax&lang=en&region=US&focus=product>. Last Updated 2015. Date Accessed 12-3-2015.
125. U.S. National Library of Medicine (NLM). ChemID Plus. <http://chem.sis.nlm.nih.gov/chemidplus/>. Last Updated 2015. Date Accessed 9-14-2015.
126. Lonza. Information brochure: Aldo™ and Polyaldo™ Specific Emulsifier Solution for All Types of Formulations [pamphlet]. 2014.
127. BASF. Technical Information: Cremophor® GS 32 (Polyglyceryl-3 Distearate). <http://dewolfchem.com/wp-content/uploads/2013/08/Cremophor-GS-32.pdf>. Last Updated 2006. Date Accessed 12-1-2015.
128. Parchem. Data sheet. Polyglyceryl-10 Distearate. [www.parchem.com/Polyglyceryl-10-Distearate-getpdf-012393.aspx](http://www.parchem.com/Polyglyceryl-10-Distearate-getpdf-012393.aspx). Last Updated 1993. Date Accessed 9-11-2015.
129. FTA Global. Polyglyceryl isopalmitate/sebacate. <http://www.ftaglobal.com/data/show-4449.html>. Last Updated 2013. Date Accessed 9-15-2015.
130. ChemNet. 73296-86-3; Isooctadecanoic acid, ester with oxybis[propanediol] (polyglyceryl-2 isostearate). <http://www.chemnet.com/cas/en/73296-86-3/Dermol-DGMIS-.html>. Last Updated 2015. Date Accessed 9-15-2015.
131. Goldschmidt AG. ISOLAN® GI 34 (Polyglyceryl-4 Isostearate). [http://www.quetzalquimica.com/images/DS\\_ISOLAN\\_GI\\_34\\_e10-08-2007.pdf](http://www.quetzalquimica.com/images/DS_ISOLAN_GI_34_e10-08-2007.pdf). Last Updated 2007. Date Accessed 9-18-2015.
132. The Good Scents Company. Polyglyceryl-6 Distearate. <http://www.thegoodscentscompany.com/data/rw1300381.html>. Last Updated 2015. Date Accessed 12-3-2015.
133. Lonza. Information pamphlet: Polyaldo™ HGDS KFG (6-2-S) (Polyglyceryl-6 Distearate) [pamphlet]. 2015.
134. Lubrizol. Technical data sheet (TDS-371): Hydramol™ TGL Ester (Polyglyceryl-3 Laurate). <https://www.lubrizol.com/Personal-Care/Documents/Technical-Data-Sheets/TDS-371-Hydramol%E2%84%A2-TGL-Ester.pdf>. Last Updated 2014. Date Accessed 3-31-2015.
135. Barnet Products Corporation. Product specifications: Decaglyn 1-M (polyglyceryl-10 myristate; CAS No. 87390-32-7). <http://www.barnetproducts.com/pdfs/specs/Decaglyn%201M.pdf>. Last Updated 2002. Date Accessed 9-14-2015.
136. Evonik Industries. TEGO® Care PL 4 (Polyglyceryl-4 Laurate). [http://glenncorp.com/wp-content/uploads/2013/11/DS\\_TEGO\\_Care\\_PL\\_4\\_e-1.pdf](http://glenncorp.com/wp-content/uploads/2013/11/DS_TEGO_Care_PL_4_e-1.pdf). Last Updated 2009. Date Accessed 4-10-2015.
137. Evonik Industries. ISOLAN® GO 33 (Polyglyceryl-3 Oleate). [http://www.finecon.sk/admin/pdf/DS\\_ISOLAN\\_GO\\_33\\_e.pdf](http://www.finecon.sk/admin/pdf/DS_ISOLAN_GO_33_e.pdf). Last Updated 1999. Date Accessed 4-10-2015.
138. Anonymous. 2016. Composition and physical and chemical properties Polyglyceryl-4 Oleate. Unpublished data submitted by Personal Care Products Council.
139. The Good Scents Company. Polyglyceryl-10 Oleate. <http://www.thegoodscentscompany.com/data/rw1366941.html>. Last Updated 2015. Date Accessed 10-30-2015.
140. Lonza. Information brochure: Polyaldo™ 10-1-O KFG (NON GMO) (Polyglyceryl-10 Oleate) [pamphlet]. 2014.
141. SAAPedia. Polyglyceryl palmate. <http://www.saapedia.org/en/saa/?type=detail&id=4420>. Last Updated 2013. Date Accessed 11-17-2015.

142. SAAPedia. Polyglyceryl pentacaprylate. <http://www.saapedia.org/en/saa/?type=detail&id=4481>. Last Updated 2013. Date Accessed 12-3-2015.
143. Stepan. NEOBEE® Medium Chain Triglycerides, WECOBEE® Triglycerides, DREWPOL® Polyglycerol Esters, and DREWMULSE® Mono and Diglycerides. <http://webcache.googleusercontent.com/search?q=cache:kIZTsQtW7KsJ:www.stepan.com/workarea/downloadasset.aspx%3Fid%3D1459+&cd=6&hl=en&ct=clnk&gl=us>. Last Updated 2008. Date Accessed 12-12-0015.
144. Medolla. Technical datasheet: Olivatis 12 (Polyglyceryl-3 Pentaolive). [http://www.coastsouthwest.com/wp-content/uploads/2014/05/medolla\\_olivatis\\_12.pdf](http://www.coastsouthwest.com/wp-content/uploads/2014/05/medolla_olivatis_12.pdf). Last Updated 2014. Date Accessed 3-30-2015.
145. Nikko Chemicals Co. Ltd. Safety Data Sheet: NIKKOL Decaglyn 5-OV (Polyglyceryl-10 Pentaoleate). [https://www.chemical-navi.com/english/product\\_search/view126.html](https://www.chemical-navi.com/english/product_search/view126.html). Last Updated 2014. Date Accessed 12-1-2015.
146. Nikko Chemicals Co. Ltd. Product Details: NIKKOL Decaglyn 5-OV (Polyglyceryl-10 Pentaoleate). [https://www.chemical-navi.com/english/product\\_search/detail66.html](https://www.chemical-navi.com/english/product_search/detail66.html). Last Updated 2010. Date Accessed 12-1-2015.
147. Nikko Chemicals Co. Ltd. Product Details: NIKKOL Tetraglyn 5-S (Polyglyceryl-4 Pentastearate). [https://www.chemical-navi.com/english/product\\_search/detail356.html](https://www.chemical-navi.com/english/product_search/detail356.html). Last Updated 2010. Date Accessed 12-1-2015.
148. Parchem. Specifications: Polyglyceryl-6 Pentastearate. [www.parchem.com/Polyglyceryl-6-Pentastearate-getpdf-012391.aspx](http://www.parchem.com/Polyglyceryl-6-Pentastearate-getpdf-012391.aspx). Last Updated 1991. Date Accessed 12-3-2015.
149. Dowin Chemical. Polyglyceryl-6 Pentastearate (99734-30-2 ). <http://dowinchem.trustexporter.com/product/detail/99/666577.htm>. Last Updated 2015. Date Accessed 12-3-2015.
150. Nikko Chemicals Co. Ltd. Product Details: NIKKOL Decaglyn 5-SV (Polyglyceryl-10 Pentastearate). [https://www.chemical-navi.com/english/product\\_search/detail67.html](https://www.chemical-navi.com/english/product_search/detail67.html). Last Updated 2010. Date Accessed 12-1-2015.
151. The Good Scents Company. Polyglyceryl-10 Pentastearate. <http://www.thegoodscentscompany.com/data/rw1480771.html>. Last Updated 2015. Date Accessed 12-1-2015.
152. Progressus s.r.l. 2015. Material safety data sheet PROLIX RB (Polyglyceryl-3 Rice Branate). Unpublished data submitted by Personal Care Products Council.
153. AAK. Product information: Akoline PGPR (Polyglyceryl-3 Ricinoleate). [http://aak.com/Global/Products/Beauty%20and%20personal%20care/Emulsifiers/aak-lfc\\_akoline\\_pgpr\\_0808.pdf](http://aak.com/Global/Products/Beauty%20and%20personal%20care/Emulsifiers/aak-lfc_akoline_pgpr_0808.pdf). Last Updated 2008. Date Accessed 4-1-2015.
154. Dr. Straetmans Chemische Produkte GmbH. Product information: dermofeel® GO (Polyglyceryl-2 Sesquioleate). <http://www.lucasmeyercosmetics.com/mailling/pdf/DermofeelGOsoft-ProductInformation.pdf>. Last Updated 2012. Date Accessed 12-1-2015.
155. SAAPedia. Polyglyceryl soyate/shear butterate. <http://www.saapedia.org/en/saa/?type=detail&id=4432>. Last Updated 2013. Date Accessed 9-17-2015.
156. Nisshin Oillio Group Ltd. Raw materials for the cosmetics industry. <http://www.nisshin-oillio.com/english/products/pdf/finechemicals.pdf>. Last Updated 2013. Date Accessed 11-17-2015.
157. Nikko Chemicals Co. Ltd. Product Details: Nikkol Decaglyn 1-SV (Polyglyceryl-10 Stearate). [https://www.chemical-navi.com/english/product\\_search/detail60.html](https://www.chemical-navi.com/english/product_search/detail60.html). Last Updated 2010. Date Accessed 10-30-2015.
158. Abitec. Material Safety Data Sheet: Caprol 10G40 (Polyglyceryl-10 Tetraoleate; CAS No. 34424-98-1). [http://www.abiteccorp.com/wp-content/files\\_mf/1343830278Caprol10G40.pdf](http://www.abiteccorp.com/wp-content/files_mf/1343830278Caprol10G40.pdf). Last Updated 2005. Date Accessed 12-1-2015.
159. U.S. Environmental Protection Agency (EPA). Substance Details - Octadecanoic acid, tetraester with oxybis[propanediol]. [http://iaspub.epa.gov/sor\\_internet/registry/substreg/searchandretrieve/advancedsearch/externalSearch.do?p\\_type=CASNO&p\\_value=72347-89-8](http://iaspub.epa.gov/sor_internet/registry/substreg/searchandretrieve/advancedsearch/externalSearch.do?p_type=CASNO&p_value=72347-89-8). Last Updated 2015. Date Accessed 12-1-2015.
160. Nihoh Emulsion Co., Ltd. Material Safety Data Sheet: Emalex TCCG-10 (Polyglyceryl-10 Tricocoate). [https://www.nihon-emulsion.co.jp/pdf/msds/TCCG-10\\_E\\_MSDS.pdf](https://www.nihon-emulsion.co.jp/pdf/msds/TCCG-10_E_MSDS.pdf). Last Updated 2013. Date Accessed 12-1-2015.

161. SAAPedia. Polyglyceryl tridecanoate. <http://www.saapedia.org/en/saa/?type=detail&id=4501>. Last Updated 2013. Date Accessed 12-1-2015.
162. Nihoh Emulsion Co., Ltd. Material Safety Data Sheet: Emalex TISG-10 (Polyglyceryl-10 Triisostearate). [https://www.nihon-emulsion.co.jp/pdf/msds/TISG-10\\_E\\_MSDS.pdf](https://www.nihon-emulsion.co.jp/pdf/msds/TISG-10_E_MSDS.pdf). Last Updated 2014. Date Accessed 12-1-2015.
163. Nihoh Emulsion Co., Ltd. Product info: Emalex TISG-10 (Polyglyceryl-10 Triisostearate). <https://translate.google.com/translate?hl=en&sl=ja&u=https://www.nihon-emulsion.co.jp/products/detail/EMALEX%2520TISG-10&prev=search>. Last Updated 2015. Date Accessed 12-1-2015.
164. Nikko Chemicals Co. Ltd. Product Details: NIKKOL Decaglyn 3-OV (Polyglyceryl-10 Trioleate). [https://www.chemical-navi.com/english/product\\_search/detail63.html](https://www.chemical-navi.com/english/product_search/detail63.html). Last Updated 2010. Date Accessed 12-1-2015.
165. Nikko Chemicals Co. Ltd. Product Details: NIKKOL Decaglyn 3-SV (Polyglyceryl-10 Tristearate). Last Updated 2010. Date Accessed 12-1-2015.
166. Progressus s.r.l. 2015. Material safety data sheet PROLIX RO (Rice Brain Oil Polyglyceryl-3 Esters). Unpublished data submitted by Personal Care Products Council.
167. Progressus. Prolix RO (Rice Bran Oil Polyglyceryl-3 Ester). <http://www.progressus.it/en/products-2/>. Last Updated 2015. Date Accessed 12-3-2015.
168. Lubrizol. Product Specifications: Schercemol™ PTID Ester (Triisostearoyl Polyglycerol-3 Dimer Dilinoleate). <https://www.lubrizol.com/Personal-Care/Documents/Specifications/Schercemol%E2%84%A2-PTID-Ester.pdf>. Last Updated 2008. Date Accessed 3-10-2015.
169. Lubrizol. Technical data sheet (TDS-403): Schercemol™ PTID Ester (Triisostearoyl Polyglyceryl-3 Dimer Dilinoleate). <https://www.lubrizol.com/Personal-Care/Documents/Technical-Data-Sheets/TDS-403-Schercemol%E2%84%A2-PTID-Ester.pdf>. Last Updated 2009. Date Accessed 3-11-2015.
170. AVG Personal Care. Viatenza® Ximenia PO6 (Ximenia Americana Seed Oil Polyglyceryl-6 Esters). [http://translate.google.com/translate?hl=en&sl=it&u=http://www.avgpersonalcare.it/%28A%28mOMli\\_fDygEkAAAYTY1NjUyZDUtZDgwMS00NzhILWJiOTYtZTM3NTAxOGZiZDlmb58x4ypbPeRWwGO0KtXbz4sjaQ1%29S%28gxx5te45ank1x045cte4xt2b%29%29/Attivo.aspx%3FActiveID%3D117%26FunctionID%3D123%26ProductID%3D20%26CategoryID%3D10&prev=search](http://translate.google.com/translate?hl=en&sl=it&u=http://www.avgpersonalcare.it/%28A%28mOMli_fDygEkAAAYTY1NjUyZDUtZDgwMS00NzhILWJiOTYtZTM3NTAxOGZiZDlmb58x4ypbPeRWwGO0KtXbz4sjaQ1%29S%28gxx5te45ank1x045cte4xt2b%29%29/Attivo.aspx%3FActiveID%3D117%26FunctionID%3D123%26ProductID%3D20%26CategoryID%3D10&prev=search). Last Updated 2014. Date Accessed 3-11-2015.
171. Gattefossé. Plurol® Stearique WL 1009 (Polyglyceryl-6 Distearate). <http://www.gattefosse.com/en/products/plurol-stearique-wl-1009.html>. Last Updated 2015. Date Accessed 4-10-2015.
172. CREMER OLEO GmbH & Co. KG. CremerCOOR® PG4 Cocoate (Polyglyceryl-4 Cocoate). <http://www.cremeroleo.de/en/produktbereiche/cremer-care/produkte/CremerCOOR-PG4-Cocoate-Solubilizers.php>. Last Updated 2015. Date Accessed 10-15-2015.
173. Vantage Specialty Ingredients. Neosolue® -Aqua (Polyglyceryl-10 Eicosanedioate/Tetradecanedioate). <http://www.lipochemicals.com/products/neosolue-aqua>. Last Updated 2015. Date Accessed 11-17-2015.