Safety Evaluation of Polyethylene Glycol (PEG) Compounds for Cosmetic Use

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Polyethylene glycols (PEGs) are products of condensed ethylene oxide and water that can have various derivatives and functions. Since many PEG types are hydrophilic, they are favorably used as penetration enhancers, especially in topical dermatological preparations. PEGs, together with their typically nonionic derivatives, are broadly utilized in cosmetic products as surfactants, emulsifiers, cleansing agents, humectants, and skin conditioners. The compounds studied in this review include PEG/PPG-17/6 copolymer, PEG-20 glyceryl triisostearate, PEG-40 hydrogenated castor oil, and PEG-60 hydrogenated castor oil. Overall, much of the data available in this review are on PEGylated oils (PEG-40 and PEG-60 hydrogenated castor oils), which were recommended as safe for use in cosmetics up to 100% concentration. Currently, PEG-20 glyceryl triisostearate and PEGylated oils are considered safe for cosmetic use according to the results of relevant studies. Additionally, PEG/PPG-17/6 copolymer should be further studied to ensure its safety as a cosmetic ingredient.

Key words: Polyethylene glycol (PEG), PEG compound, Safety evaluation

INTRODUCTION

Polyethylene glycols (PEGs) are composed of polyether compounds repeating ethylene glycol units according to the constituent monomer or parent molecule (as ethylene glycol, ethylene oxide, or oxyethylene) (Fig. 1). Most PEGs are commonly available commercially as mixtures of different oligomer sizes in broadly- or narrowly-defined molecular weight (MW) ranges. For instance, PEG-10,000 typically designates a mixture of PEG molecules (n = 195 to 265) having an average MW of 10,000. PEG is also known as polyethylene oxide (PEO) or polyoxyethylene (POE), with the three names being chemical synonyms. However, PEGs mainly refer to oligomers and polymers with molecular masses below 20,000 g/mol, while PEOs are polymers with molecular masses above 20,000 g/mol, and POEs are polymers of any molecular mass. Relatively small molecular weight PEGs are produced by the chemical reaction between ethylene oxide and water or ethylene glycol (or other ethylene glycol oligomers), as catalyzed by acidic or basic catalysts. To produce PEO or high-molecular weight PEGs, synthesis is performed by suspension polymerization. It is necessary to hold the growing polymer chain in solution during the course of the poly-condensation process. The reaction is catalyzed by magnesium-, aluminum-, or calcium-organoelement compounds. To prevent coagulation of polymer chains in the solution, chelating additives such as dimethylglyoxime are used (1).

PEGs, together with their derivatives, do not have definite chemical entities, rather, they are compound mixtures having different chain lengths. PEGs are used in cosmetics as is or in combination with their derivatives in which their 2 terminal primary hydroxyl groups can create mono-, di- and poly-esters, amines, ethers and acetals. Furthermore, PEGs can create additional compounds and complexes through a reaction in their ether bridges. Overall, PEG derivatives may include PEG ethers (e.g. laureths, ceteths, ceteareths, oleths, and PEG ethers of glyceryl cocoates), PEG fatty acids (e.g. PEG laurates, dilaurates, stearates, and distearates), PEG castor oils, PEG amine...
ethers (PEG cocamines), PEG propylene glycols, and other derivatives (e.g., PEG soy sterols and PEG beeswax). Since many PEG types are hydrophilic, they are favorably used as penetration enhancers, especially in topical dermatological preparations (2). Polyethylene glycols (PEGs) and their derivatives are widely used in cosmetics as surfactants, cleansing agents, emulsifiers, skin conditioners, and humectants.

Adding to their use in cosmetics, many PEG compounds also have other applications. Available information from these uses is included in this assessment where relevant. In the pharmaceutical industry, for instance, they are used as ointment bases or vehicles for drugs in capsules, tablet and pill binders, suppositories, and liquid prescriptions; and in veterinary drugs as part of parenteral, topical, ophthalmic, oral, and rectal preparations. Further various applications were found in soaps and detergents, wood preservation, printing, chemical mixtures, as well as in industries that produces textiles, leather, plastics, resins, paper, ceramics, glass, rubber, petroleum, and metal. Polyoxyethylene sorbitan esters (polysorbates) and polyethylene glycol, with an average molecular weight of 6,000, are permitted as food additives in various food products (3,4).

In previous studies, PEGs and various PEG compounds have been reviewed and assessed well to be concluded as relatively safe for use in cosmetics under the present conditions of intended use (3,5,6). However, all PEG compounds were not covered in the previous studies due to their wide variety, and the introduction of new entities currently used in cosmetics suggests supplementary evaluation. Thus, it is essential to continuously monitor the safety and risks of PEG-derived products being exposed to consumers using cosmetic products to ensure that no potential health threats will arise, especially when used extensively and chronically. In this review, we searched for and enumerated the PEG polymers and their derivatives that are used in cosmetics (Table 1) in order to evaluate the safety of their application according to the currently available information in the literature.

**PEG COMPOUNDS FOR COSMETIC USE**

**PEG/PPG-17/6 copolymer.** PEG/PPG-17/6 copolymer is a randomly produced chemical comprised of an average of 17 ethylene glycol repeats and 6 propylene glycol repeats (7). This mixture does not have a specific CAS number, rather, it is found to be included in the generic CAS number 9003-11-6, belonging to the general group of “poloxamers”. A cosmetic ingredient review regarding alkyl PEG-PPG ethers has been conducted, however it was not specified whether PEG/PPG-17/6 copolymer is a related mixture based on the given list (8). Accordingly, little is known about the toxicological properties of PEG/PPG-17/6 copolymer and thus, studies reflected in this review may be...
| Polymer                        | Functional Group/Compound                  | CAS No.                     | INCI name                        | Commercial name            | Description as cosmetic ingredients                                                                 |
|-------------------------------|--------------------------------------------|-----------------------------|----------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------|
| Almond Glycerides             |                                            |                             | MULSIFAN CAO 02                  |                           | Co-emulsifier. It is an ethoxylated, virgin almond oil with non-ionic character used for the preparation of w/o emulsions. |
| Castor Oil                    |                                            | 61791-12-6; 107853-28-1     |                                 |                           | Emulsifying agents and surfactants.                                                                   |
| Cocamine                      |                                            | 61791-14-8; 12610-15-0      | PEG-2 COCAMINE                   | Sabopal NC 2              | Alkaline emulsions like hair-dye creams or gels.                                                    |
| Dilaurate                     |                                            | 9005-02-01                  | Pegosperse™ 200 DL               |                           | Nonionic emulsifier for neutral and mildly alkaline and acidic systems. It is a fluid emulsifier, dispersant and spreading agent. |
| Dimedowfoamamido              |                                            |                             | PEG-2 DIMEADOWFOAMAMIDO          | Meadowquat® HG            | Produced by reacting meadowfoam seed oil to form this sulfated (nonchloride) quaternium compound for enhancing the conditioning effects of meadowfoamate. |
| Tallowamine                   |                                            |                             | HYDROGENATED TALLOW AMINE        | Protox T-2                | Used in shampoos. Emulsifier, anti-irritant, neutralizing agent, anti-static agent, a foam booster and a mild detergent. |
| Laurate SE                    |                                            |                             | GALACTENE                       |                           | Emollient. Used for delicate and dry skins, soaps, syndets, shampoo. Available in powder form.        |
| Milk Solid                    |                                            |                             | PEG-2 OLEAMINE                   | Sabopal NO 2              | Used for alkaline emulsions like hair-dye creams or gels.                                            |
| Oleate                        |                                            | 106-12-7                    | PEG-2 OLEATE                     | Nikkol MYO-2              | Lipophilic emulsifier obtained by the addition of ethylene oxide to fatty acids.                     |
| Soyamine                      |                                            | 61791-24-0                  | PEG-2 SOYAMINE                   | Protox S-2; Ethomeen® SV/12| Used in shampoos. Emulsifier, anti-irritant, neutralizing agent, anti-static agent, a foam booster and a mild detergent. |
| Stearate                      |                                            | 106-11-6                    | PEG-2 STEARATE                   | Nikkol MYS-2              | Lipophilic emulsifier obtained by the addition of ethylene oxide to fatty acids.                     |
| Stearyl Ether                 |                                            | 9005-00-9                   | Acconon® SA-2                   |                           | Used in the formulation of cosmetic O/W or W/O emulsions in combination with other emulsifiers.       |
| Tallowamine                   |                                            | 61791-26-2                  | PEG-2 TALLOW AMINE               | Hetoxamine T-2; Sabopal NS 2 | Anti-static agent and as emulsifier for waxes and oils. It is formed by the reaction of fatty primary amines with ethylene oxide. |
| Polymer | Functional Group/Compound | CAS No. | INCI name | Commercial name | Description as cosmetic ingredients. |
|---------|---------------------------|---------|-----------|-----------------|---------------------------------------|
| Disodium oleamido PEG-2 | Sulfo succinate |  | Cola® Mate OPA-30 | Characterized by mildness and the ability to moderate the irritation of anionics on the skin. |
| C12-18 Alcohol | ISOXAL -5 |  | O/W and w/o emulsifier and solubilizer. Used in skin oils, anhydrous preparations, microemulsions, bath oils and decorative cosmetics. |
| Castor Oil | 61791-12-6; 107853-28-1 | Emulsifiers and surfactants. |
| Dicaprylate/Dicaprate | 68583-52-8 | PEG-3 DICAPRYLATE/CAPRATE | Dub 810 TEG | Emollient. Used in cosmetic products. |
| Dimethicone |  | Emulsil® S-391 | Water soluble silicone copolyol surfactant used as plasticizer and solubilizer in cosmetic systems. Used in hair, skin and body care. |
| Distearate | 91031-45-7; 9005-08-7; 25062-49-1 | PPG-5-LAURETH-5; PEG-3 DISTEARATE | Cutina® TS; Tegint® D1102; Nikkol Estepearl 30V; Genapol® TS Powder | Opacifying agent and pearlescer for the preparation of surfactant washing and cleansing preparations. |
| Lauryl Ether | GLYCOLENE | O/w type emulsifier, solubilizer, emollient and humectant. It is non-sticky and soluble in water, glycerin as well as in glycols. Used in lotions, tonics and gel. |
| Stearate | 9005-08-7; 15583-47-9 | Emulsifying agents. |
| Magnesium-PEG-3 | Cocamide Sulfate | 122998-71-4 | MAGNESIUM PEG-3 COCAMIDE SULFATE | Hydriosul® AMG30 | Thickener. Used in cosmetics. |
|  | 25322-68-3 | PEG-4 | Sabopeg 200; POGOL® 200; Jeechem 200 | Humectant. Used in shower and bath products, creams and lotions, shampoos, shaving products and liquid soaps. |
| Cellulose |  | ALCORAMNOSAN | Rheology modifier. It is a gelling agent only for water/ethanol systems. It does not form any dry film on the surface of the skin (artificial desquamation). |
| Dheptanoate | PEG-4 DIHEPTANOATE | Liponate® 2-DH | Skincare anti-aging, skincare anti-acne, skincare treatment, skincare moisturization, skincare protection, sun care, color cosmetics and hair care. |
| Efa Proline Ester |  | AMINOEFADERMA | Nourishing agent for skin suppleness, hair treatment and conditioning. Offers anticellulitic-, local anti-inflammatory- and bioenergetic properties. |
### Table 1. Continued

| Polymer | Functional Group/Compound | CAS No. | INCI name | Commercial name | Description as cosmetic ingredients. |
|---------|---------------------------|---------|-----------|-----------------|-------------------------------------|
| PEG-4   | Laurate                   | 9004-81-3 | PEG-4 LAURATE | Pegosperse® 200 ML | Versatile mild HLB range surface active agent. For use in products with high clarity. Emulsions Liquid products Lotions Liquid products Oils. |
|         | Oleate                    | 9004-96-0; 10108-25-5 | PEG-4 OLEATE | Jeemate 200-OC; Hydrol® OP.2 | Used as emulsifiers and dispersing agents for creams, lotions and bath oils. |
|         | Olivate                   | 226708-41-4 | PEG-4 OLVATE | Olivem 700 | Used in cosmetic formulations. |
|         | Polyglyceryl-2 Stearate   | 72828-11-6 | PEG-4 POLYGLYCERYL-2 STEARATE | Hostacerin® DGSB | Used in liquid and creamy oil-in-water emulsions. Acts as an emulsifier and co-emulsifier with special emulsifying effect on vegetable oils. |
|         | Rapeseedamide             | 85536-23-8 | PEG-4 RAPESEEDAMIDE | Amidet® N; Masamide® R-4 | Liquid non-ionic surfactant with good thickening and foam properties. Also acts as co-surfactant, thickener, emulsifier, moisturizers and solubilizer. |
|         | Stearate                  | 9004-99-3; 106-07-0 | PEG-4 STEARATE | Jeemate 200-DPS; Nikkol MYS-4; Sabowax SE 4 | Used as emulsifiers and dispersing agents for creams, lotions and bath oils. |
|         | Stearyl Ether             | 9005-00-9 | Acconon® SA-4 | | Nonionic emulsifier and wetting agent. Used in bath products as well as cleansing products such as cold creams and cleansing lotions. |
| PEG-5   | C12-C18 Alcohol           | ISOXAL -12 | | | O/W non-ionic co-emulsifier and solubilizer. It is solid and soluble in triglycerides, glycerol, propylene glycol as well as partially soluble in mineral oils. |
|         | Castor Oil                | 61791-12-6 | PEG-5 CASTOR OIL | Etocas® 5; Surfactol® 318 | O/W co-emulsifier, w/o coemulsifier and dispersing agent. Used in skin care creams, lotions, bath products, sprayable emulsions, eyecare, feet, hands, nails and sun protection. |
|         | Cocamine                  | PEG-5 COCAMINE | Protox C-5 | | Acts as emulsifier, anti-irritant, neutralizing agent, anti-static agent, a foam booster and a mild detergent. |
|         | Laurate                   | 9004-81-3 | Jeemate 200-ML | | Emulsifiers and dispersing agents for creams, lotions and bath oils. |
|         | Oleammonium Methosulfate  | 64611-81-0 | PEG-5 OLEAMMONIUM METHOSULFATE | Accoquat® OMS-5 | An easy-to-use organic quaternary ammonium compound derived from oleic acid. Acts as water-soluble conditioning and light moisturizing agent. |
|         | Oleate                    | 68441-03-2 | PEG-5 OLEATE | HETOXAMATE MO - 5 | Emulsifier, surfactant and coupling agent. |
|         | Rapeseed Sterol           | 61791-24-0 | PPG-5-LAURETH-5 | Generol® R E5 | Nonionic co-emulsifier for the preparation of cosmetic emulsions of the type W/O. |
|         | Soyamine                  | Ethomeen® SV/25 | | | Resin neutralizer, rheology modifier, surfactant, emulsifier and wetting agent. It is used in a variety of hair care application areas. |
| Polymer       | Functional Group/Compound | CAS No. | INCI name                      | Commercial name           | Description as cosmetic ingredients                                                                 |
|---------------|---------------------------|---------|--------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------|
| PEG-5         | Stearate                  | 9004-99-3 | PEG-5 STEARATE               | Hetoxamate SA-5           | Surfactant/emulsifier for ointments, creams, lotions, face moisturizers, and other skin care products. |
|               | Stearyl Ammonium Lactate  | 55896-85-0 | PEG-5 STEARYL AMMONIUM LACTATE | Genamin® KSL              | Antistatic agent. Used in hair finishing rinses, liquid setting lotions, conditioning shampoos, hair colourants, hair tonics and all hair after-treatment products. |
| Dihydroxypropyl | Linoleammonium Chloride  | 168677-75-6 | PEG-5 LINOLEAMMONIUM CHLORIDE | Incroquat Sl-5; Cola® Quat SLCC | Conditioning agent. Gives lubricity and has very good wet comb properties. Compatible with anionics. Used in bath & shower products. |
| PEG-6         | Caprylic/Capric Glycerides | 52504-24-2 | PEG-6 CAPRYLIC/CAPRIC GLYCERIDES | Saboderm CC; Oxypon CC6; Tegosoft® GMC 6; DERMAROL 6CC | Ointments, creams, milks and toiletries. |
|               | Cocamide                  |          | PEG-6 OLEATE                  | Dub DO PEG-6              | Non-ionic surfactant used as emulsifier and detergent. Used in hair care. |
|               | Oleamine                  | 9005-07-06 | PEG-6 OLEAMINE                | Sabopal NO 6              | Emulsifier. Used in cosmetic products. |
|               | Oleate                    | 9004-99-0; 60344-26-5; 9004-96-0 | PEG-6 OLEATE                | Jeemate 300-OC; Hydriol® OP.3; Nikkol MYO-6 | Emulsifiers and dispersing agents for creams, lotions and bath oils. |
| Sorbitan Oleate | Sorbitan Oleate          | 9005-65-6 | PEG-6 SORBITAN OLEATE         | Nikkol TO-106V            | Used in cosmetics. |
| Sorbitan Stearate | Sorbitan Stearate      | 9005-67-8 | PEG-6 SORBITAN STEARATE       | Nikkol TS-106V            | Used in cosmetics. |
| Stearate      |                           |          | PEG-6 STEARATE                | Jeemate 300-DPS; Sabowax SE 6 | Emulsifiers and dispersing agents for creams, lotions and bath oils. |
| Almond oil    | Esters                    |          | ALMOND OIL. PEG-6 ESTERS      | Saboderm AMD              | Ointments, creams, milks and toiletries. |
| Hydrogenated  | Hydrogenated Esters       |          | HYDROGENATED PALM/PALM KERNEL OIL. PEG-6 ESTERS | Dub G1218 A | Emollient. Increasing penetration. Used in milk and cream. |
| PEG-7         | Amodimethicone            |          | PEG-7 AMODIMETHICONE          | SILSENSE™ A-21 SPECIALTY SILICONE | Used in aqueous systems including shampoos, rinse-out conditioners, leave-in conditioners, styling products, body washes, bath gels, liquid soaps and bubble baths, body washes. |
| Polymer | Functional Group/Compound | CAS No. | INCI name | Commercial name | Description as cosmetic ingredients. |
|---------|---------------------------|---------|-----------|-----------------|--------------------------------------|
| Dimethicone Beeswax | | | | | |
| Glyceryl Cocoate | PEG-7 GLYCERYL COCOATE | 68553-03-7; 68201-46-7; 68105-29-1 | Emanor® HE; Jeechem GC-7; Saboderm HE; Sterol LG/492; CETAROL HE 7 | Emollient. Is non-ionic surfactant, perfumes and extracts solubilizer. Used in hair care, men's grooming products, skin care, bath and shower products. |
| Glyceryl Soyate | PEG-7 GLYCERYL SOYATE | | CHEMONIC™ SI-7 SURFACTANT | Used in shampoos, body washes, shower gel formulations and other personal care formulations. Acts as a nonionic surfactant derived from soy oil. |
| Hydrogenated Castor Oil | PEG-7 HYDROGENATED CASTOR OIL | 61788-85-0 | Crodur™ 7; Cremophor® Wo 7 | W/O emulsifier, particularly recommended for lotions. Used for baby care, body care, facial care, sun care, eye products, facial make-up, lip products, shower gel/body. |
| Olivate | PEG-7 OLIVATE | 226708-41-4 | Olivem 300 | Used in cosmetic formulations. |
| Ammonium dimethicone PEG-7 | | | | |
| Sulfate | | | | |
| Avocadoate | DIMETHICONE PEG-7 AVOCADOATE | | SILSENSE™ DW-AV | Used in hair and skin care. Acts as an emollient, co-emulsifier and a surfactant. Possesses conditioning and spreading properties. |
| Cocoate | DIMETHICONE PEG-7 COCOATE | | SILSENSE® SW-12 SPECIALTY SILICONE | Used in hair and skin and may be used in products including creams, body lotions, after-shave balms and gels, shampoos and conditioners. Acts as a conditioning agent. |
| Isostearate | DIMETHICONE PEG-7 ISOSTEARATE | | SILSENSE® DW-18 SPECIALTY SILICONE | Used in creams, body lotions, after-shave balms and gels, shampoos and conditioners. Acts as a lubricant and emollient. |
| Dimethicone PEG-7 | | | | |
| Olivate | DIMETHICONE PEG-7 OLIVATE | | SILSENSE™ DW-O | Used in skin care and hair care like shampoos and conditioners. Acts as a co-emulsifier and an emollient. |
| Phosphate | DIMETHICONE PEG-7 PHOSPHATE | 132207-31-9 | Pecosil® PS-150 | Provide greater substantivity, enhanced smoothing and slip while retaining its water-solubility property for ease of formulation. |
| Phthalate | DIMETHICONE PEG-7 PHTHALATE | | SILSENSE™ CA-1 | Used in shampoos, conditioners, body washes, gels, mousses and styling products. Acts as a conditioning and complexing agent. |
| Succinate | DIMETHICONE PEG-7 SUCCINATE | | SILSENSE™ CA-2 | Used in shampoos, conditioners, body washes, gels, mousses and styling products. Acts as a conditioning and complexing agent. |
| Olive oil PEG-7 Esters | OLIVE OIL PEG-7 ESTERS | 103819-46-1 | Beautyolea S3; Olivatis 1 | Acts as a secondary surfactant and emulsifier or co-emulsifier in O/W systems. It is obtained from pure Italian olive oil. |
| Polymer                        | Functional Group/Compound       | CAS No.       | INCI name                                      | Commercial name | Description as cosmetic ingredients                                      |
|-------------------------------|---------------------------------|---------------|-----------------------------------------------|----------------|--------------------------------------------------------------------------|
| Sodium PEG-7 Olive Oil Carboxylate |                                | 226416-05-3  | SODIUM PEG-7 OLIVE OIL CARBOXYLATE            | Olivem 400      | Used as mild surfactant in hair and skin care products.                  |
| Steardimonium Hydroxypropyl PEG-7 Dimethicone Phosphate Chloride |                                | 220714-63-6  | STEARDIMONIUM HYDROXYPROPYL PEG-7 DIMETHICONE PHOSPHATE CHLORIDE | Pecosil® PSQ-418 | Film forming and emollient. Used in shampoos and conditioners.          |
| Beewax                        | PEG-8                           | 25322-68-3   | Sympatens PEG-400; Pluracare® E 400; Jeechem 400; Sabopeg 400 |                | Polyethyleneglycol with approx molecular weight 400 (8 EO). Re-fatting agent. Emulsions Liquid products Lotions. |
| C12-C20 Alkyl Ester           | PEG-8 BEESWAX                   |              | Wax -PEG-8 Beeswax; Conon 2680; Dub CIRE A    |                | Used in creams, lotions, make-ups, hair care, mascaras, lipsticks, lip-balms and sunscreen products. |
| Cellulose                     | PEG-8                           |              | IDRORAMNOSAN                                   |                | Gelling agent, humectant and viscosity regulator for emulsions (easily dispersed in water, relatively short dissolving time). |
| Diisostearate                 | PEG-8 DIISOSTEARATE             |              | Nikkol CDIS-400                                |                | Emulsifier.                                                              |
| Dilaurate                     | PEG-8 DILAURATE                 | 9005-02-01   | HallStar® PEG 400 DL; Jeeamate 400 DL; Saboderm PDC |                | Biodegradable emulsifier (o/w), co-emulsifier, emollient, lubricant and spreading agent. Used in bath additives, facial cleansers, facial skin care and hand & body care. |
| Dimethicone Olivate           | DIMETHICONE PEG-8 AVOCADOATE    |              | Silwax® WD-AV                                  |                | Used in creams, body lotions, after-shave balms and gels, shampoos and conditioners. Possesses tack reducer and gloss enhancer. |
| Dioleate                      | PEG-8 DIOLEATE                  | 9005-07-06   | HallStar® PEG 400 DO; Jeeamate 400-DO; Citrol 4DO |                | Emollient, emulsifying agent (o/w) and lubricant. Used in eye area color cosmetics, facial skin care as well as in hand & body care. |
| Distearate                    | PEG-8 DISTEARATE                | 9005-08-07   | HallStar® PEG 400 DS; Jeeamate 400 DS; Pegosperms® 400 DS; Nikkol CDS-400 |                | Emulsifier (o/w), emollient, opacifying agent and/or conditioning agent in various products. Is biodegradable and plant derived / vegetal based. |
| Dodecenylsuccinate            | PEG-8 DODECENYL SUCCINATE       |              | Surfine SM 2030                                 |                | Used in shower gels, baby products, hypoallergenic products, make up removers, bubble baths, shampoos and body washes. Acts as surfactant and an emulsifier. |
| Glyceryl Laurate              | PEG-8 GLYCERYL LAURATE          |              | Glycerox™ L8                                   |                | O/W emulsifier. Superfatting agent and solubiliser in aqueous and aqueous alcoholic preparations. Emollient in creams and lotions. Dispersant and wetting agent. |
| Polymer          | Functional Group/Compound | CAS No.         | INCI name                           | Commercial name | Description as cosmetic ingredients. |
|------------------|---------------------------|----------------|-------------------------------------|-----------------|--------------------------------------|
| Isocetyl/isostearyl Ether Stearate | 9004-81-3 | PEG-8 LAURATE | HallStar® PEG 400 ML; Jeemate 400-ML | Emulsifier (o/w), emollient and lubricant. Is biodegradable and plant derived / vegetal based. Used in after sun skin care, beach wear sun care, daily wear sun care. |
| Olate            | 9004-96-0; 61791-00-2 | PEG-8 OLEATE  | Jeemate 400-OC; Hydriol® OP.4; Alkamuls® 400 MO | Emulsifiers and dispersing agents for creams, lotions and bath oils. |
| Silane           | PEG-8 METHYL ETHER TRIETHOXYSILANE | BGBO-SW2 | Hydrophilic coating for pigments and powders. |
| Stearate         | PEG-8 STEARATE            | Jeemate 400-DPS; Sabowax SE 8 | Emulsifiers and dispersing agents for creams, lotions and bath oils. |
| Trisiloxane      |                          | SM3340P | Wetting agent and surfactant having very low surface tension. Compatible for Oil and water coupling. Imparts soft silky feel, long-lasting color protection. |
| Apricot Kernel Oil PEG-8 | Esters | APRICOT KERNEL OIL PEG-8 ESTERS | Viatenza® Apricot PE8 | Obtained by trans-esterification between PEG-8 and apricot kernel oil. Used in shampoo for dry and damaged hair, bath products, creams for face. |
| Argan Oil PEG-8  | Esters | ARGAN OIL PEG-8 ESTERS | Viatenza® Argan PE8 | Used in shampoos for dry and damaged hair, bath products, face hygiene, hand care and care creams. |
| Avocado Oil PEG-8 | Esters | AVOCADO OIL PEG-8 ESTERS | Viatenza® Avocado PE8 | Used in shampoos for damaged hair, bath products, products for aging skin and products for around the eyes. |
| Babassu Oil PEG-8 | Esters |                          | Viatenza® Cupuaçu PE8 | Used in shampoos for damaged hair, bath products, cleansing wipes and milks, personal and face hygiene products. |
| Baobab Oil PEG-8 | Esters |                          | Viatenza® Baobab PE8 | Used in bath products, shampoos, cleansing wipes and milks, hand care products, personal and face hygiene products. |
| Bertholletia Excelsa Seed Oil - PEG 8 | Esters | BERTHOLLETTIA EXCELSA SEED OIL PEG-8 ESTERS | Hydramazon Excelsa | Used in shampoos, liquid and bar soaps, skin cleansers and toners, anti-wrinkle creams and lotions, baby products and hair conditioning gels. |
| Bitter Cherry Seed Oil PEG-8 | Esters | BITTER CHERRY SEED OIL PEG-8 ESTERS | Viatenza® Cherry PE8 | Used in shampoos for dry hair, bath products, sun care, face hygiene and in creams for dry. |
| Borage Seed Oil PEG-8 | Esters | BORAGE SEED OIL POLYGLYCERYL-6 ESTERS | Viatenza® Borage PO6 | Used in shampoos for dry and damaged hair, bath products, care creams for dry and damaged skin. |
Table 1. Continued

| Polymer                        | Functional Group/Compound | CAS No.  | INCI name     | Commercial name         | Description as cosmetic ingredients.                                                                 |
|--------------------------------|---------------------------|----------|---------------|-------------------------|-------------------------------------------------------------------------------------------------------|
| Buriti Oil PEG-8               | Esters                    |          | Viatenza® Buriti PE8 |                         | Used in shampoos for damaged hair, bath products, personal and face hygiene products, cleansing wipes and milks. |
| Cocoa butter PEG-8             | Esters                    |          | Viatenza® Cocoa PE8 |                         | Used in shampoos for damaged hair, bath products, cleansing wipes and milks, personal and face hygiene product. |
| Dimethicone PEG-8              | Amine                     |          | Silamine® C-300 |                         | It is silicone active, a unique patented water dispersible silicone amine, which provides conditioning, lubricity, softening, improved combability and manageability to hair. |
|                                | Beeswax                   | DIMETHICONE PEG-8 BEESWAX ULTRABEE® WD SILICONE |                         |                         | Used in aftershave balms, mild cleansers, makeup removers, creams and lotions, shampoos and conditioners. Acts as an emollient and surfactant. |
|                                | Lanolate                  | DIMETHICONE PEG-8 LANOLATE Lanosil® |                         |                         | Acts as an excellent skin conditioning emollient and an effective hair conditioning agent. Provides good shine with an excellent soft and velvety after feel. |
|                                | Meadowfoamate             | DIMETHICONE PEG-8 MEADOWFOAMATE Fancorsil® LIM-1 |                         |                         | Is manufactured by complexing the fatty acid of the natural triglyceride meadowfoam seed oil (Limnanthes Alba) with silicone. |
|                                | Polyacrylate              | DIMETHICONE PEG-8 SUCCINATE Silsoft™ Surface |                         |                         | Acts as a film former. Possesses non-transfer capabilities with excellent feel and water resistance. May improve wearability in cosmetic applications. |
|                                | Succinate                 | DIMETHICONE PEG-8 SUCCINATE Silube® CS-I |                         |                         | Used in deodorant sticks, fragrance oils, hair conditioner, creams and lotions. Reduces tack and soapy feel. Aids in reducing tack and stickiness. |
| Disodium PEG-8                 | Palm Glycerides Sulfosuccinate |           | DISODIUM PEG-8 PALM GLYCERIDES SULFOSUCCINATE Sabosol RSS |                         | Used in shampoos, bubble-baths and mild detergents. Provides soft and uniform foam. Possesses good skin feel. |
| Grape Seed Oil PEG-8           | Esters                    | GRAPE SEED OIL PEG-8 ESTERS Viatenza® Grape PE8 |                         |                         | Used in shampoos for dry and damaged hair, bath products, face care, hand care, daily and emollient cream. |
| Hazelnut Seed Oil PEG-8        | Esters                    | HAZEL SEED OIL PEG-8 ESTERS Viatenza® Hazel PE8 |                         |                         | Used in shampoos for dry and damaged hair bath products, dry face and hand creams and in personal. |
| Hemp Seed Oil PEG-8            | Esters                    | Viatenza® Hemp PE8 |                         |                         | Used in shampoos for dry and damaged hair, bath products, face care, personal hygiene and day creams. |
| Macadamia Ternifolia Seed Oil PEG-8 | Esters | MACADAMIA TERNIFOLIA SEED OIL PEG-8 ESTERS Viatenza® Macadamia PE8 |                         |                         | Used in shampoos for damaged hair, bath products, creams for dry and aged skin. |
| Mafura Butter PEG-8            | Esters                    | Viatenza® Mafura PE8 |                         |                         | Used in shampoos, bath products, personal and face hygiene products, cleansing wipes and milks. |
| Polymer Group/Compound | CAS No. | INCI name | Commercial name | Description as cosmetic ingredients |
|------------------------|---------|-----------|----------------|------------------------------------|
| Mongongo Nut Oil PEG-8 | Viatenza® Mongongo PE8 | Used in shampoos, bath products, personal and face hygiene products, cleansing wipes and milks. |
| Olive Oil PEG-8 | Viatenza® Olive PE8 | Used in shampoos for dry and damaged hair, bath products, face care, day creams, emollient, and personal. |
| Orbigyna Oleifera Seed Oil - PEG 8 | Hydramazon Oleifera | Used in shampoos, liquid and bar soaps, skin toning and cleansing emulsions. Acts as a natural, vegetable-derived surfactant, anti-irritant and emollient. |
| Pumpkin Seed Oil PEG-8 | Viatenza® Pumpkin PE8 | Used in shampoos for dry and damaged hair, bath products, body and face creams and in personal. |
| Rosa Rubiginosa Seed Oil PEG-8 | Viatenza® Rose PE8 | Used in shampoos for dry and damaged hair, bath products, day creams for dry and damaged skin. |
| Safflower Seed Oil PEG-8 | Viatenza® Safflower PE8 | Used in shampoos for dry and damaged hair, bath products, face care, creams for dry skin. |
| Sclerocarya Birrea Seed Oil PEG-8 | Viatenza® Marula PE8 | Used in shampoos, bath products, personal and face hygiene products, cleansing wipes and milks. |
| Sesame Oil PEG-8 | Viatenza® Sesame PE8 | Used in shampoos, bath products, personal and face hygiene products, cleansing wipes and milks, face care product. |
| Shea Butter PEG-8 | Viatenza® Shea PE8 | Used in shampoos for damaged hair, bath products, body products, personal and face hygiene products. |
| Soybean Oil PEG-8 | Viatenza® Soybean PE8 | Used in shampoos, bath products, body products, personal and face hygiene products, cleansing wipes and milks. |
| Sunflower Seed Oil PEG-8 | Viatenza® Sunflower PE8 | Used in shampoos for dry and damaged hair, bath products, personal and face hygiene and day creams. |
| Sweet Almond Oil PEG-8 | Viatenza® Almond PE8 | Used in shampoos, bath products, personal hygiene and face hygiene and emollient creams for face. |
| Watermelon Seed Oil PEG-8 | Viatenza® Kalahari Melon PE8 | Used in shampoos for damaged hair, bath products, personal and face hygiene products. |
| Wheat Germ Oil PEG-8 | Viatenza® Wheat PE8 | Used in shampoos for dry and damaged hair, bath products, face hygiene, emollient creams for face. |
| Ximenia Oil PEG-8 | Viatenza® Ximenia PE8 | Used in shampoos, bath products, body products, personal and face hygiene products, baby care products. |
| PEG-9 | Hetoxide C-9 | Non-ionic surfactant. It is based on hydrophobe which is then reacted with ethylene oxide to accomplish specific tasks of wetting, emulsification, detergency, etc. |
| Polymer | Functional Group/Compound | CAS No. | INCI name | Commercial name | Description as cosmetic ingredients. |
|---------|---------------------------|---------|-----------|-----------------|--------------------------------------|
| PEG-9   | Isostearate               | 56002-14-3 | PEG-9 ISOSTEARATE | HETOXAMATE MI -9 | Surfactant, emulsifier and coupling agent. |
|         | Laurate                   | 9004-81-3 | PEG-9 LAURATE | HETOXAMATE LA - 9 | O/W emulsifier, surfactant and coupling agent. Polyoxylated derivatives of lauric, oleic, or stearic acid are emulsifiers, humectants, and coupling agents. |
| PEG-9   | Lauryl Ether              |         | Brij™ L9 | Anti-irritant ingredient for use in skin soothing and local anaesthetic medicated creams. |
| Stearate | 9004-99-3                | PEG-9 STEARATE | Hетoxамате SA-9 | It is generally used as a surfactant/emulsifier for ointments, creams, lotions, face moisturizers, and other skin care products. |
| Lauryl PEG-9 | Polydimethylsiloxyl Palmitate | | | A water soluble silicone copolyol surfactant used as plasticizer and solubilizer in cosmetic systems. Used in hair, skin and body care. |
|         | Polydimethylsiloxyl Dimethicone | | | A highly efficient w/o emulsifier and a great water repellent. Possesses excellent stability for emulsion. |
| PEG-10  | C12-C18 Alcohol          |  | ISOXAL -11; ISOXAL -11 P-F | O/W non-ionic co-emulsifier and solubilizer. It is solid and soluble in triglycerides, mineral oils, glycerol and water. |
| Dimethicone | PEG-10 DIMETHICONE | Silox® 2216C | Used in hair care. Offers lubricious feeling and substantivity. Adds gloss and reduces static. |
|         | Laurate                   | 9004-81-3 | PEG-10 LAURATE | Nikkol MYL-10 | Hydrophilic emulsifier obtained by the addition of ethylene oxide to fatty acids. |
| Oleamine | 9004-96-0                | PEG-10 OLEAMINE | Sabopal NO 10 | Used for alkaline emulsions like hair-dye creams or gels. |
| Oleate  | 9004-96-0                | PEG-10 OLEATE | Nikkol MYO-10 | Hydrophilic emulsifier obtained by the addition of ethylene oxide to fatty acids. |
| PEG-10  | Polyglyceryl-2 Laurate    | PEG-10 POLYGLYCERYL-2 LAURATE | Hostacerin® DGL | Used in liquid and creamy oil-in-water emulsions. Acts as a liquid emulsifier with allround emulsifying effect and as solubilizer for ethereal oils. |
| Rapeseed Sterol | PPG-5-LAURETH-5 | 68441-03-2 | Generol® R E10 | Used in cosmetic emulsions of the type O/W. Acts as a non-ionic co-emulsifier. |
| Sorbitan Laurate | PEG-10 SORBITAN LAURATE | | Liposorb® L-10 | Used for cosmetics. Offers emulsifying, thickening, lubricating, and anti-static effects. |
| Stearate | 9004-99-3                | PEG-10 STEARATE | Nikkol MYS-10 | Hydrophilic emulsifier obtained by the addition of ethylene oxide to fatty acids. |
| Sunflower Glycerides | 180254-52-8 | PEG-10 SUNFLOWER GLYCERIDES | FLORASOLVS® PEG-10 SUNFLOWER | Co-emulsifying agent, emollient, feel modification/enhancement agent, fragrance solubilizer and transfer, and superfatting agent. |
| Polymer | Functional Group/Compound | CAS No. | INCI name | Commercial name | Description as cosmetic ingredients. |
|---------|---------------------------|---------|-----------|-----------------|-------------------------------------|
| Dihydroxypropyl Stearammonium Chloride PEG-10 | | | | | Used for skin care, hair shampoos, conditioners, styling gels, other hair care products. |
| Dimethicone PEG-10 | Phosphate | 132207-31-9 | DIMETHICONE PEG-10 PHOSPHATE | Pecosil® PS-200 | Can be a "structural" component of a formulation and is ideally suited for solid delivery systems like lipsticks, makeup and anti-perspirants/deodorants. |
| Lauryl PEG-10 | Methyl Ether Dimethicone | | LAURYL PEG-10 METHYL ETHER DIMETHICONE | Silok® 2205 | Acts as an emulsifier for o/w system and water-in-silicone oil system. Also acts as a resin plasticizer for hair styling products. |
| | Tris(Trimethylsiloxy) Silyl ethyl Dimethicone | | PEG-11 METHYL ETHER DIMETHICONE | Dow Corning® ES-5300 Formulation Aid | Acts as a silicone w/o and w/si emulsifier and dispersing agent. It is a non-diluted and low viscosity silicone surfactant. |
| PEG-11 | Methyl Ether Dimethicone | 25322-68-3 | PEG-12 | Sabopeg 600; Pluracare® E 600; Pluracare® E 600 NF; Jeechem 600 | Used in cosmetic preparations. Acts as a solvent and a humectant. Possesses nonirritating and moisturizing properties. |
| | | | | | Acts as a gelling agent, humectant and viscosity regulator for emulsions (easily dispersed in water with a relatively short dissolving time). |
| | Cellulose | | | | Emulsifier (o/w), co-emulsifier and emollient. Is biodegradable and plant derived / vegetal based. Used in after sun skin care, foot care as well as in hand & body care. |
| PEG-12 | Dilaurate | 9005-02-01 | PEG-12 DILAURATE | HallStar® PEG 600 DL; Jeeamate 600-DL | Surfactant. Offers smooth and silky feel, spreadability in body care as well as in color cosmetics. Also provides soft & silky feel, wet- & dry combing in hair care. |
| | Dimethicone | | PEG-12 DIMETHICONE | BRB 526; FM-E193 | Emulsifier (o/w), co-emulsifier and emollient. Is biodegradable and plant derived / vegetal based. Used in bath additives, facial skin care, foot care, hand & body care. |
| | Dioleate | 9005-07-06 | PEG-12 DIOLEATE | HallStar® PEG 600 DO; Jeeamate 600 DO | Emulsifier (o/w), co-emulsifier and emollient. Is biodegradable and plant derived / vegetal based. Used in bath additives, facial skin care, foot care, hand & body care. |
| | Distearate | 9005-08-07 | PEG-12 DISTEARATE | HallStar® PEG 600 DS; Jeeamate 600 DS; Hetoxamate 600 DS | Emulsifier (o/w), co-emulsifier and emollient. Is biodegradable and plant derived / vegetal based. Possesses hair cuticle protection. |
| | Ditallate | 61791-01-3 | PEG-12 DITALLATE | Pegosperse® 600 DOT | Tall oil based surfactant. |
| | Laurate | 9005-02-01 | PEG-12 LAURATE | HallStar® PEG 600 ML; Pegosperse® 600 ML | Emulsifiers and dispersing agents for creams, lotions and bath oils. |
| | Oleate | 9004-96-0 | PEG-12 OLEATE | Jeeamate 600-OC | Emulsifiers and dispersing agents for creams, lotions and bath oils. |
| Polymer       | Functional Group/Compound          | CAS No.    | INCI name             | Commercial name          | Description as cosmetic ingredients                                                                 |
|--------------|-----------------------------------|------------|-----------------------|--------------------------|------------------------------------------------------------------------------------------------------|
| PEG-12       | Stearate                          | 9004-99-3 | PEG-12 STEARATE       | Jeemate 600-DPS          | Emulsifiers and dispersing agents for creams, lotions and bath oils.                                   |
| Disodium PEG-12 | Dimethicone Sulfo succinate       | 157090-37-4 | Cola® Mate SI         |                          | Extra mild surfactant derived from watersoluble silicone copolymer. Is useful in non-irritating skin cleansing and specialty applications. |
| PEG-14       | Isostearate                        | 56002-14-3 | HETOXAMATE MI - 14    |                          | Surfactant, emulsifier and coupling agent. Polyoxylated derivatives of lauric, oleic, or stearic acid are emulsifiers, humectants, and coupling agents. |
|              | Oleate                            |            | HETOXAMATE MO - 14    |                          | O/W emulsifier, surfactant and coupling agent.                                                         |
|              | Pentaeerythritol Tetra Caprylate/Caprate (Proposed) |            | AXIMOL PTC-14         |                          | Emollient. Belonging to a new class of esters that have a very low viscosity for their molecular weights. |
|              | Stearate                          |            | HETOXAMATE MS - 14    |                          | Humectant, solubilizer, surfactant, and coupling agent.                                                |
|              | Castor Oil                        | 61791-12-6 | PEG-15 CASTOR OIL     | Etocas™ 15; ALKEST® CSO 150 | Dispersing agent, o/w emulsifier, solubiliser and w/o co-emulsifier. Used in skin care creams, lotions, bath products, shower gel/body wash, liquid soaps, facial wash. |
|              | Cocamine                          |            | PEG-15 COCAMINE       | Sabopal NC 15            | Alkaline emulsions, like hair-dye creams or gels.                                                      |
|              | Cocomonium Chloride               |            | PEG-15 COCOMONIUM CHLORIDE | Maquat® C-15             | Used in 2-in-1 shampoos, restorative conditioners, conditioning hairspray, crèmes and lotions, hair conditioners and rinses. |
|              | Cocomonium Methosulfate           |            | PEG-15 COCOMONIUM METHOSULFATE | Maquat® C-15MS          | Used in 2-in-1 shampoos, restorative conditioners, conditioning hairspray, crèmes and lotions, hair conditioners and rinses. |
|              | Glyceryl Isostearate              |            | PEG-15 GLYCERYL ISO STEARATE | Oxypon 2145             | Used in shampoos, foam baths, shower gels, intimate cleansers, baby care products.                      |
|              | Glyceryl Laurate                  |            | PEG-15 GLYCERYL LAURATE | Glycerox L15             | Used in shampoos, bath foams and oils, skin care creams and lotions, colognes, athershaves and other alcoholic systems, colour cosmetics and antiperspirants. |
|              | Glyceryl Stearate                 |            | PEG-15 GLYCERYL STEARATE | Nikkol TMGS-15V         | Used in cosmetics.                                                                                     |
|              | Hydrogenated Tallowamine          |            | PEG-15 HYDROGENATED TALLOW AMINE | Protox T-15             | Used in shampoos. Acts as emulsifier, anti-irritant, neutralizing agent, anti-static agent, a foam booster and a mild detergent. |
| Polymer | Functional Group/Compound | CAS No. | INCI name | Commercial name | Description as cosmetic ingredients. |
|---------|---------------------------|---------|-----------|-----------------|-----------------------------------|
| PEG-15  | Laurate                   | 61791-29-5 | Jeemate 600 ML | Emulsifier and dispersing agent for creams, lotions and bath oils. |
|         | Monomerate                |         | HETOXAMATE MA - 15 | Surfactant, emulsifier and coupling agent. Polyoxylated derivatives of lauric, oleic, or stearic acid are emulsifiers, humectants, and coupling agents. |
|         | Tallow Amine              | PEG-15 TALLOW AMINE | Sabopal NS 15 | Alkaline emulsions like hair-dye creams or gels. |
| PEG-16  | Almond Glycerides         | 25322-68-3 | PEG-16 Polyglykol 800 | Used in tooth pastes and perfumes. Acts as a humectant, solubilizer, antistatic agent and fixative. Posesses softening, non-irritating and cleansing properties. |
|         | Hydrogenated Castor Oil   | PEG-16 HYDROGENATED CASTOR OIL | Protachem CAH-16 | Co-emulsifier. It is an ethoxylated, virgin almond oil with non-ionic character supporting both, the formation of stable w/o as well as o/w emulsions. |
|         | Macadamia Glycerides      | 220459-99-4 | PEG-16 MACADAMIA GLYCERIDES | FLORASOLVS® PEG-16 MACADAMIA | Co-emulsifying agent, emollient, fragrance solubilizer, moisturizing agent, solubilizing agent, and superfatting agent. |
| PEG-20  | Almond Glycerides         | 124046-50-0 | PEG-20 ALMOND GLYCERIDES | Crovol A-40 | Used in soap formulations, bath oil products, styling mousses, water-based aerosols, antiperspirants and astringents. Acts as a high HLB nonionic emulsifier and conditioner. |
|         | Glyceryl Laurate          | PEG-20 GLYCERYL LAURATE | Tagat® L2 | Surfactant and solubilizer in shampoos, shower and foam bath preparations and O/W emulsions. Possesses foam enhancing properties. |
|         | Glyceryl Oleate           | PEG-20 GLYCERYL OLEATE | Tagat® O 2 V | Used in shampoos, shower and foam bath preparations and O/W emulsions. |
|         | Glyceryl Stearate         | 68153-76-4 | PEG-20 GLYCERYL STEARATE; PPG-5-LAURETH-5 | Tagat® S 2; Cutina® E 24 | Emulsifier and solubilizer for shampoos, shower and foam bath preparations and O/W emulsions. |
|         | Hydrogenated Lanolin      | PEG-20 HYDROGENATED LANOLIN | Fancol® HL-20 | Super-fatting agent and a solubilizer. Helps for micro emulsions. A gelling agent for transparent gels. Used in creams, lotions and decorative cosmetics. |
| Polymer          | Functional Group/Compound          | CAS No. | INCI name                  | Commercial name                  | Description as cosmetic ingredients                                                                 |
|------------------|------------------------------------|---------|----------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------|
| PEG-20           | Methyl Glucose Sesquisteartate      |         | PEG-20 METHYL GLUCOSE SESQUISTEARATE | GLUCAMATE™ SSE-20 EMULSIFIER       | Used in makeup and in skin care like creams and lotions. Acts as an oil in water emulsifier, cleanser and stabilizer. |
|                  | Oleamine                           | 9004-96-0 | PEG-20 OLEAMINE             | Sabopal NO 20                    | Used for alkaline emulsions like hair-dye creams or gels.                                            |
|                  | Oleate                             | 9004-99-3 | PEG-20 STEARATE             | Cerasynt® 840; Sabowax SE 20     | Used in personal care. Acts as an emulsifier and superfatting agent. Offers increased viscosity and stability. |
|                  | Sorbitan Isostearate               | 66794-58-9 | PEG-20 SORBITAN ISOSTEARATE | Nikkol TI-10V                    | Used in cosmetics.                                                                                   |
| Bis-PEG-20       | Dimethicone                        |         | BIS-PEG-20 DIMETHICONE      | SF 1388                          | Enhances the soft silky feel and boosting foam in water base products such as shampoos, conditioners and body wash as well as wash ability of antiperspirants. |
| Tribehenin       | Esters                             |         | TRIBEHENIN PEG-20 ESTERS    | Emulium® 22                      | Used in skin care, sun care, hair care and makeup applications. Offers evanescent feel. Improves spreadability and boosts SPF. |
| PEG-22           | Laurate                            | 61791-29-5 | LAURETH-23                  | Jeemate 1000-ML                  | Emulsifiers and dispersing agents for creams, lotions and bath oils.                                 |
|                  | Oleate                             | 9004-96-0 | LAURETH-23                  | Jeemate 1000-OC                  | Emulsifiers and dispersing agents for creams, lotions and bath oils.                                 |
|                  | Stearate                           | 9004-99-3 | LAURETH-23                  | Jeemate 1000-DPS                 | Emulsifiers and dispersing agents for creams, lotions and bath oils.                                 |
| Tallow Amine     |                                   |         | Sabopal NS 22               |                                  | Alkaline emulsions like hair-dye creams or gels.                                                      |
| PEG-23           | Lauryl Ether                       |         | LAURETH-23                  | Brij™ L23; Polyoxyl lauryl ether NF | Nonionic surfactant, solubiliser and wetting agent.                                                   |
| PEG-24           | Dimethicone                        |         | PEG-24 HYDROGENATED LANOLIN | FM-2501; Cosmtheticone® SF-230   | Emulsifiable and imparts soft and glossy feel in product.                                           |
| Hydrogenated Lanolin |                       | 68648-27-1 | HYDROGENATED CASTOR OIL     | Fancoil® HL-24; Supersat AWS-24  | Super-fatting agent and a solubilizer. Helps for micro emulsions. A gelling agent for transparent gels. Used in creams, lotions, decorative cosmetics. |
| PEG-25           | Hydrogenated Castor Oil            |         | PEG-25 HYDROGENATED CASTOR OIL | Fancoil® HL-24; Supersat AWS-24  | Super-fatting agent and a solubilizer. Helps for micro emulsions. A gelling agent for transparent gels. Used in creams, lotions, decorative cosmetics. |
| Oleamine         | PEG-25 OLEAMINE                    |         | Sabopal NO 25               | Uvinul® P25                      | Alkaline emulsions like hair-dye creams or gels.                                                      |
| Paba             | PEG-25 PABA                         | 113010-52-9 |                          |                                  | Used in skin cosmetics, hair care like gels and shampoos, colorant, setting lotions, normal and gloss hair sprays. Acts as a UV-B filter. |
| Polymer | Functional Group/Compound | CAS No. | INCI name | Commercial name | Description as cosmetic ingredients. |
|---------|---------------------------|---------|-----------|----------------|--------------------------------------|
| PEG-25  | Stearate                  | 9004-99-3 | PEG-25 STEARATE | Nikkol MYS-25 | Hydrophilic emulsifier obtained by the addition of ethylene oxide to fatty acids. |
|         | Tallow Amine              |         |           | Sabopal NS 25  | Alkaline emulsions like hair-dye creams or gels. |
| PEG-26  | Glycerine                 |         | GLYCERETH-26 | Sabopal NS 25  | Emollients, emulsifiers, thickeners, stabilizers, opacifiers and pearlescent agents for such products as creams, lotions, shaving creams and cream shampoos. |
| PEG-27  | Lanolin                   |         | PEG-27 LANOLIN |         | Super-fatting conditioner and moisturizer. Restores lost lipids and imparts sheen. Used in hair care and skin care formulations. |
| PEG-29  | Castor Oil                | 61791-12-6 | PEG-29 CASTOR OIL | Etocas™ 29  | Dispersing agent, o/w emulsifier, solubiliser, w/o co-emulsifier. Used in skin care creams, lotions, bath products, shower gel/body wash, liquid soaps and facial wash. |
|         | Almond Glycerides         | 61791-12-6 | MULSIFAN CAO 30 |         | Co-emulsifier. It is an ethoxylated, virgin almond oil with non-ionic character used for the preparation of o/w emulsions. |
|         | Castor Oil                | 68201-46-7 | PEG-30 CASTOR OIL | Sabowax EL 30; Alkamuls® B | Used in toiletries, ointments and in transparent gels. |
|         | Dipolyhydroxystearate     |         | PEG-30 GLYCERYL COCOATE | Sabowax PIS; Simaline WO; Cithrol™ DPHS | Used for medium viscosity creams. Acts as a water-in-oil emulsifier, to stabilize all types of oil effectively at low concentrations with textures ranging from lotion to thick cream. |
| PEG-30  | Glyceryl Cocoate          | 68201-46-7 | PEG-30 GLYCERYL COCOATE | Jeechem GC-30 | Used in baby shampoo formulations, oil and bath formulations. Possesses very mild. Offers good skin compatibility and mucous membrane compatibility. |
|         | Glyceryl Soyate           |         | PEG-30 GLYCERYL SOYATE | CHEMONIC™ SI-63 SURFACTANT | Used in baby shampoos, baby washes, sensitive skin formulations, fragrances and oils. |
|         | Glyceryl Stearate         |         | PEG-30 GLYCERYL STEARATE | Tagat® S | Used in shampoos, shower and foam bath preparations and O/W emulsions. |
|         | Lanolin                   | 61790-81-6 | PEG-30 LANOLIN | BELPOL L-30 | Non-ionic emolliating surfactant that can be used as a hydrophilic emulsifier. It is obtained from secretion of sheep's sebaceous glands. |
|         | Oleamine                  |         | PEG-30 OLEAMINE | Sabopal NO 30 | Alkaline emulsions like hair-dye creams or gels. |
|         | Tallow Amine              |         | PEG-30 TALLOW AMINE | Sabopal NS 30 | Alkaline emulsions like hair-dye creams or gels. |
| Polymer Group/Compound | CAS No. | INCI name | Commercial name | Description as cosmetic ingredients |
|------------------------|---------|-----------|-----------------|-------------------------------------|
| PEG-32                 | 25322-68-3 | PEG-32 | Sympatens PEG-1500 G; Renex™ PEG 1500; Jeechem 1450; Sabopeg 1500; Pluracare® E 1450 NF | Polyethyleneglycol with approx. molecular weight 1500 (32 EO). Emulsions Liquid products Lotions. |
| Stearate               |         | Jee mate 1540-DPS | Emulsifiers and dispersing agents for creams, lotions and bath oils. |
| Sunflower Seed Oil PEG-32 |    | SUNFLOWER SEED OIL PEG-32 ESTERS | Viatenza® Oleic Sunflower PE32 | Used in shampoos for damaged hair, bath products, face care, personal and face hygiene. |
| PEG-35                 |         | PEG-35 CASTOR OIL | Etocas™ 35 | O/W emulsifier, w/o coemulsifier, solubiliser and dispersing agent. Used in skin care creams, lotions, bath products, shower gel/body wash, liquid soaps and facial wash. |
| Soy Glycerides        | 61791-23-9 | PEG-35 SOY GLYCERIDES | Acconon® S-35 | Low-melt solid, water soluble vegetable oil derivative obtained from refined soybean oil. It is nonionic and compatible with other ionic species in formulation. |
| PEG-36                 | 61791-12-6 | PEG-36 CASTOR OIL | Alpicare CO 36; ALKEST® CSO 360 | Nonionic solubilizing agent for fragrances, essential oils, lipophilic actives and vitamins. |
| PEG-40                 | 25322-68-3 | PEG-40 Polyglykol 2000 S | Humectant, solubilizer, antistatic agent and a fixative. Possesses softening, cleansing and non-irritating properties. |
| Castor Oil            | 61791-12-6 | PEG-40 CASTOR OIL | Jeechem CA-40; Sabowax EL 40 | Used for lotions, creams, hair care and lipsticks. Possesses perfume solubilizer, emollient, emulsifier, lubricant, and dispersant. |
| Hydrogenated Castor Oil | 61788-85-0 | PEG-40 HYDROGENATED CASTOR OIL; PPG-5-LAURETH-5 | Findet® ARH/52; Alkypo® ROX CO 40; Sabowax ELH 40; Cremophor® CO 40; Eumulgin® HRE 40 | Non-ionic surfactant acts as extracts, perfumes and vitamins solubilizer. Used in hair care, men’s grooming products, skin care, bath and shower products. |
| Lanolin                | 8051-82-9; 61790-81-6 | PEG-40 LANO LIN | Laneto 40 | Used in shampoos, conditioners, bath preparations, creams, lotions, as well as soap and detergent systems. Acts as an emollient, lubricant and solubilizer. |
| Sorbitan Periso stearate | PEG-40 SORBITAN PERISO ST EARATE | Tego® SIS 40 | Used in W/O skin care lotions and creams and bath products. Offers good emulsifying and solubilizing properties. |
| Sorbitan Peroleate     | PEG-40 SORBITAN PEROLEATE | Arlatone™ TV | Spreading agent of exceptionally high efficiency as well as liquid W/O co-emulsifier. Used in bath & shower products, baby care, body care, facial care and sun care. |
| Stearate               | 9004-99-3 | PEG-40 STE ARATE | Jeemate 2000-DPS Flake; Nikkol MYS-40; Ritox 52; Sabowax SE 40 | Emulsifiers and dispersing agents for creams, lotions and bath oils. |
| Polymer | Functional Group/Compound | CAS No. | INCI name | Commercial name | Description as cosmetic ingredients. |
|---------|--------------------------|---------|-----------|-----------------|-------------------------------------|
| **PEG-42** | Babassu Glycerides | PEG-42 BABASSU GLYCERIDES | Crovol BA70G | Used in skin care products, detergent cleansers, bath and shower products, shampoos and conditioners, styling products, aftershave cologne and body sprays. |
| **PEG-45** | Palm Kernel Glycerides | 124046-52-2 PEG-45 PALM KERNEL GLYCERIDES | Crovol PK-70 | Used in skin care products, bath and shower products, shampoos and conditioners, styling products, aftershave cologne and body sprays, antiperspirants and deodorants. |
| **Stearate** | | 9004-99-3 PEG-45 STEARATE | Nikkol MYS-45 | Hydrophilic emulsifier obtained by the addition of ethylene oxide to fatty acids. |
| **Hydrogenated Castor Oil** | PEG-50 HYDROGENATED CASTOR OIL | | Protachem CAH-50 | Used in personal care products. Acts as non-ionic surfactant, emulsifier, solubilizer and conditioner. |
| **Hydrogenated Palamamide** | 544-31-0 | Ethomid® HP/60 | Rheology modifier, wetting agent. It is an ethoxylated amide which is used in a variety of applications to provide dispersibility and rheology. |
| **PEG-50** | Lanolin | 61790-81-6 PEG-50 LANOLIN | BELLPOL L-50 | Non-ionic emolliating surfactant that can be used as a hydrophilic emulsifier. It is obtained from secretion of sheep’s sebaceous glands. |
| **Shea Butter** | PEG-50 SHEA BUTTER | Shebu WS | Used in water-based products, such as shampoos, conditioners, creams, lotions and other products. Acts as an emollient. |
| **Stearate** | 9004-99-3 PEG-50 STEARATE | Myrj™ S50; Ritox 53 | Co-emulsifier for o/w systems and conditioning agent. Used in body care, facial care, baby care, creams, lotions, cleaners, toners, skin treatments, feet, hands. |
| **Tallowamine** | 61791-26-2 (g) | Hetoxamine T-50 | Anti-static agent and as emulsifier for waxes and oils. It is formed by the reaction of fatty primary amines with ethylene oxide. |
| **PEG-54** | Castor Oil | 61791-12-6 PEG-54 CASTOR OIL | ALKEST® CSO 540 | Emulsifier, solubilizer, emollient, dispersing agent and humectant. It is a non-ionic surfactant. |
| **Hydrogenated Castor Oil** | PEG-40 HYDROGENATED CASTOR OIL | Croduret™ 54 | Effective solubiliser of perfumes, essential oils and lipophilic actives for use in microemulsions. Imparts superfattening benefits in detergent systems. |
| **PEG-55** | Stearate | 9004-99-3 PEG-55 STEARATE | Nikkol MYS-55 | Hydrophilic emulsifier obtained by the addition of ethylene oxide to fatty acids. |
| **PEG-60** | | 25322-68-3 PEG-60 | Polyglykol 3000 S | Acts as a slip and mold-release agent, solubilizer, carrier, thickener and antistatic agent. Possesses binding, softening and non-irritating properties. |
| **Almond Glycerides** | 124046-50-0 PEG-60 ALMOND GLYCERIDES | Crovol™ A-70 | Non-ionic surfactant, emulsion stabiliser, dispersant, emollient, plasticiser, solubiliser, superfattening agent and wetting agent. |
| Polyol/Group | CAS No. | INCI name | Commercial name | Description as cosmetic ingredients. |
|-------------|---------|-----------|-----------------|-------------------------------------|
| Castor Oil  | 61791-12-6 | PEG-60 CASTOR OIL | Jeechem CA-60 | Used for lotions, creams, hair care and lipsticks. Possesses perfume solubilizer, emollient, emulsifier, lubricant, and dispersant. |
| Corn Glycerides | | PEG-60 CORN GLYCERIDES | Crovol M-70 | Used in skin care products, shampoos and conditioners, bath and shower products, styling products, aftershaves, colognes and body sprays, antiperspirants and deodorants. |
| Evening Primrose Glycerides | | PEG-60 EVENING PRIMROSE GLYCERIDES | Crovol EP70 | Used in skin care products, detergent cleansers, bath and shower products, shampoos and conditioners, styling products, aftershaves and colognes. |
| Hydrogenated Castor Oil | 61788-85-0 | PEG-60 HYDROGENATED CASTOR OIL; PPG-5-LAURETH-5 | Sabowax ELH 60; Cremophor® CO 60; Eumulgin® HRE 60 | Used in toiletries, ointments and transparent gels. |
| Lanolin | 8039-09-06 | PEG-60 LANOLIN | Jeelan L-60 | Emulsifiers, stabilizers, emollients, moisturizers and absorption bases for creams, lotions, liquid make-up and general purpose cosmetics. |
| Maracuja Glycerides | | | Crovol™ Maracuja | Plasticiser, solubiliser, superfatting agent, water soluble emollient and counter irritant. |
| Lanolin | 61790-81-6; 61790-81-7; 61790-81-8 | PEG-75 LANOLIN | Promollient® AL PEG-75; Jeelan L-75; Jeelan L-75/50; Findet® LN/8750 | Ethoxylated derivative of lanolin which has emulsifying, solubilizing, wetting and cleansing properties and is an ideal product for soaps and cleansing gel. |
| Meadowfoam Seed Oil | 61790-81-6; 8039-09-6; 61790-81-7; 61790-81-8 | PEG-75 MEADOWFOAM OIL | Meadowsol® 75:75 | Emulsifier. Helps disperse and wet pigments. Boosts and stabilizes the foam. Provides the emolliency, conditioning and superfatting properties. |
| Shea Butter Glycerides | | PEG-75 SHEA BUTTER GLYCERIDES | Crovol SB75/50 | Emulsion stabiliser, wetting agent, dispersant and superfatting agent. Possesses emollient, plasticiser and solubiliser properties. |
| Glyceryl Cocoate | 68201-46-7 | PEG-78 GLYCERYL COCOATE | DUB CG 7 | Emulsifier. Used in bath preparation, alcoholic lotion, shampoo, clear cream and surfactant for microemulsion. |
| Glyceryl Cocoate | | PEG-80 GLYCERYL COCOATE | Corum 9860; CHEMONIC™ LI-6875 SURFACTANT | Super-fatting agent, easily soluble in water, alcohol and the majority of organic solvents. |
| Sorbitan Laurate | 9005-64-5; 68154-33-6 | PEG-80 SORBITAN LAURATE | Hetsorb L-80-72%; Tween™ 28; Alkamuls® PSML-80/72 | Emulsifier for oils, lubricant, solvent and viscosity control agent. It is an ethoxylated sorbitan ester ideal for cosmetics and personal care formulations. |
| Polymer   | Functional Group/Compound          | CAS No.        | INCI name          | Commercial name                  | Description as cosmetic ingredients.                                      |
|-----------|-----------------------------------|----------------|--------------------|-----------------------------------|------------------------------------------------------------------------------|
| PEG-81    | Castor Oil                        |                | HETOXIDE C - 81   | Humectant and solubilizer.        |                                                                              |
|           | PEG-90                            | 25322-68-3     | PEG-90             | Pluracare® E 4000 Flakes          | Used in cosmetics formulations. Acts as a humectant, binder, solubilizer and absorption promoter. Possesses non-irritating and moisturizing properties. |
| PEG-90    | Apricot Kernel Glycerides         |                | PEG-90 Pluracare® E 4000 Flakes | HYDRAMOL™ PGDS ESTER | Used in skin care products, detergent cleansers, bath and shower products, shampoos and conditioners, styling products, aftershaves, colognes and body sprays. |
|           | Diisostearate                     | 36493-25-1     | PEG-90 DiISOSTEARATE |                                | Used in hair treatment, antiperspirant and deodorant and in creamy gels. Acts as an emollient. Possesses conditioning and viscosity building properties. |
| PEG-100   | Almond Glycerides                 |                | MULSIFAN CAO 100  |                                | Emulsifier. It is an ethoxylated, virgin sweet almond oil with non-ionic character used for the preparation of o/w emulsions. |
|           | Stearate                          | 9004-99-3      | PEG-100 STEARATE   | HallStar® PEG 4400 MS; Jeemate 4400 DPS; Sabowax SE 100 | Non-ionic emulsifier (o/w) from petrochemical and vegetal sources. Used in after sun skin care, antiperspirants, beach wear sun care, cleansing wipes. |
| PEG-120   | Methyl Glucose Dioleate           | 86893-19-8     | PEG-120 METHYL GLUCOSE DIOLEATE | Antil® 120 Plus; Rethick DOE120 | Used in hair shampoo, shower gel, foam bath, liquid soap or hand wash paste. Offers very good thickening properties. Reduces the irritation potential of surfactants. |
|           |                                   |                | Sabopec 6000; Pluracare® E 6000 Flakes |                                | Used in cosmetic formulations. Acts as a humectant, binder, solubilizers and absorption promoter. Possesses nonirritating and moisturizing properties. |
|           | Distearate                        | 9005-08-07     | PEG-150 DISTEARATE | Rewopal® PEG 6000 DS; HallStar® PEG 6000 DS; REWOPAL® PEG 6000 DS A; HallStar® PEG 6000 DS C; Jeemate 6000-DS; Nikkel CDS-6000P | Used in baby shampoos, mild hair shampoos, foam baths and shower shampoos and skin cleansing lotions. Offers distinctive viscosity modifying effect. |
| PEG-150   | Pentaeerythrityl Tetrastearate    | 130249-48-8    | PEG-150 PENTAERYTHRITYL TETRASTEARATE | Crothix™ | Rheology modifier or thickening agent. Used in hair shampoos, antidianduff shampoos, shower gels and foam baths. |
|           | Polyglyceryl-2 Tristearate        | 72828-11-6     | PEG-150 POLYGLYCERYL-2 TRISTEARATE | Genapol® DAT 100 | Used in shampoos, body washes and shower gels. Acts as an easy to handle, liquid associative thickener and conditioning agent. |
|           | Stearate                          | 9004-99-3      | PEG-150 STEARATE   | HallStar® PEG 6000 MS            | Cleansing agent, co-emulsifying agent, emulsifying agent (w/o), solubilizing agent and thickener. Used in foot care, hair conditioners and hand & body care. |
| Polymer | Functional Group/Compound | CAS No.     | INCI name         | Commercial name | Description as cosmetic ingredients. |
|---------|---------------------------|-------------|------------------|-----------------|--------------------------------------|
| PEG-175 | Disostearate              | PEG-175    | DIISOSTEARETE    | HEST HVB        | Excellent viscosity builder for shampoo, shower gel, bubble bath. |
| PEG-180 |                          | 25322-68-3 | PEG-180          | Pluracare® E 8000 Flakes | Used in cosmetics formulations. Acts as a humectant, binder, solubilizer and absorption promoter. Possesses non-irritating and moisturizing properties. |
| PEG-200 |                          |            | PEG-200          | Etocas™, Protachem CA-200 | Humectant, shower and bath products, creams and lotions, shampoos, shaving products and liquid soaps. |
| PEG-200 | Castor Oil                |            | PEG-200 CASTOR OIL | O/W emulsifier. Used in bath products, liquid soaps, facial wash, hair treatments, sun protection, male grooming, baby care and hair styling. |
| PEG-200 | Glyceryl Stearate         |            | Simulsol 220     | Thickening, non-ionic surfactant foaming agent used in foaming formulas. Reduces irritation. Is preservative-free. |
| PEG-200 | Hydrogenated Glycerol Palm | PEG-200    | HYDROGENATED GLYCERYL PALMATE | Vegetable based emulsifier with solubilizing and thickening properties. It is very compatible to skin, mucous membrane. |
| PEG-200 | Laurate                   | PEG-200    | Perfume fixative. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. In lotions, acts as a cleansing agent. |
| PEG-200 | USP                       | 25322-68-3 | PEG-4            | Perfume fixative. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. In lotions, acts as a cleansing agent. |
| PEG-220 |                          | 25322-68-3 | PEG-220          | Polyglykol 10000 P | Used in skin care. Acts as a slip and mold-release agent, solubilizer, carrier, thickener and antistatic agent. Possesses binding, softening and non-irritating properties. |
| PEG-240 |                          | 25322-68-3 | PEG-240          | Polyglykol 12000 P | Used in skin care. Acts as a slip and mold-release agent, solubilizer, carrier, thickener and antistatic agent. Possesses binding, softening and non-irritating properties. |
| PEG-300 |                          |            | PEG-6            | PEG-6           | Humectant, shower and bath products, creams and lotions, shampoos, shaving products and liquid soaps. |
| PEG-300 | USP                       |            | PEG-6            | Humectant. Used in shower and bath products, creams and lotions, shampoos, shaving products and liquid soaps. |
| PEG-400 |                          |            | PEG-400          | Protachem 400   | Used in personal care products. Acts as emollient, lubricant, solvent, emulsifier and stabilizer. Possesses thickening, opacifying and surfactant properties. |
| PEG-400 | USP                       |            | PEG-8            | Humectant. Used in shower and bath products, creams and lotions, shampoos, shaving products and liquid soaps. |
| PEG-450 |                          | 25322-68-3 | PEG-450          | Polyglykol 20000 P | Used in skin care. Acts as a slip and mold-release agent, solubilizer, carrier, thickener and antistatic agent. Possesses binding, softening and non-irritating properties. |
| Polymer       | Functional Group/Compound | CAS No.   | INCI name | Commercial name | Description as cosmetic ingredients.                                                                 |
|--------------|---------------------------|-----------|-----------|-----------------|-------------------------------------------------------------------------------------------------------|
| PEG-600      |                           | 25322-68-3 | PEG-12    |                 | Humectant, shower and bath products, creams and lotions, shampoos, shaving products and liquid soaps. |
| PEG-600 USP  |                           |           | PEG-12    |                 | Humectant. Used in shower and bath products, creams and lotions, shampoos, shaving products and liquid soaps. |
| PEG-800      |                           | 25322-68-3 | PEG-800   | Polyglykol 35000 S | Used in skin care. Acts as a slip and mold-release agent, solubilizer, carrier, thickener and antistatic agent. Possesses binding, softening and non-irritating properties. |
| PEG-6000     |                           | 25322-68-3 | PEG-150   |                 | Slip and mold-release agent. Water-soluble carrier substance. Softener. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. |
| PEG-1000     |                           | 25322-68-3 | PEG-20    |                 | Perfume fixative. Softener. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. In lotions, acts as a cleansing agent. |
| PEG-2000     |                           | 25322-68-3 | PEG-40    |                 | Perfume fixative. Softener. Non-greasy lubricant. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. In lotions, acts as a cleansing agent. |
| PEG-1500     |                           | 25322-68-3 | PEG-32    |                 | Perfume fixative. Softener. Non-greasy lubricant. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. In lotions, acts as a cleansing agent. |
| PEG-1500F    |                           |           | PEG-32    |                 | Perfume fixative. Softener. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. In lotions, acts as a cleansing agent. |
| PEG-3000     |                           | 25322-68-3 | PEG-60    |                 | Slip and mold-release agent. Water-soluble carrier substance. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. |
| PEG-3350     |                           | 25322-68-3 | PEG-75    | Protachem 75    | Softener. Slip and mold-release agent. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. Can be used in transparent toothpastes. |
| PEG-4000     |                           | 25322-68-3 | PEG-90    |                 | Slip and mold-release agent. Water-soluble carrier substance. Softener. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. |
| PEG-8000     |                           | 25322-68-3 | PEG-180   |                 | Slip and mold-release agent. Water-soluble carrier substance. Softener. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. |
| PEG-10000    |                           | 25322-68-3 | PEG-220   |                 | Slip and mold-release agent. Water-soluble carrier substance. Softener. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. |
| Polymer Group/Compound | CAS No.       | INCI name | Commercial name   | Description as cosmetic ingredients.                                                                 |
|------------------------|--------------|-----------|-------------------|-------------------------------------------------------------------------------------------------------|
| PEG-12000              | 25322-68-3  | PEG-240   |                   | Slip and mold-release agent. Softener. Water soluble carrier substances. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. |
| PEG-20000              | 25322-68-3  | PEG-350   |                   | Slip and mold-release agent. Softener. Water-soluble carrier substances. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. |
| PEG-35000              | 25322-68-3  | PEG-800   |                   | Slip and mold-release agent. Water-soluble carrier substance. Softener. Moisture-stabilizing effect in creams. Leaves a pleasant feel on the skin. |
| PEG-2M                 | 25322-68-3  | PEG-2M    | ALKOX® L-11        | Emollient and lubricant. Improves wet combing and provides skin conditioning, foam stability and retention. Used in shampoos, conditioners, soap bar/liquid, lotions, creams. |
| PEG-5M                 | 25322-68-3  | PEG-5M    | Rita PEO-1         | Used in personal care products. Offers mildness, lubricity and film forming properties.               |
| PEG-7M                 | 25322-68-3  | PEG-7M    | ALKOX® E-20G       | Emollient and lubricant. Improves wet combing and provides skin conditioning, foam stability and retention. Used in shampoos, conditioners, soap bar/liquid, lotions and creams. |
| PEG-9M                 | 25322-68-3  | PEG-9M    | Rita PEO-2         | Used in personal care products. Offers mildness, lubricity and film forming properties.               |
| PEG-14M                | 25322-68-3  | PEG-14M   | ALKOX® E-45G       | Emollient and lubricant. Improves wet combing and provides skin conditioning, foam stability and retention. Used in shampoos, conditioners, soap bar/liquid, lotions, creams. |
| PEG-20M                | 25322-68-3  | PEG-20M   | ALKOX® E-60G       | Emollient and lubricant. Improves wet combing and provides skin conditioning, foam stability and retention. Used in shampoos, conditioners, soap bar/liquid, lotions, creams. |
| PEG-23M                | 25322-68-3  | PEG-23M   | Rita PEO-3         | Used in personal care. Offers mildness, lubricity and film forming properties.                      |
| PEG-45M                | 25322-68-3  | PEG-45M   | ALKOX® E-75G       | Acts as an emollient and lubricant. Improves wet combing and provides skin conditioning, foam stability and retention. Used in shampoos, conditioners, soap bar/liquid, lotions, creams. |
| PEG-65M                | 25322-68-3  | PEG-65M   | ALKOX® E-100       | Emollient and lubricant. Improves wet combing and provides skin conditioning, foam stability and retention. Used in shampoos, conditioners, soap bar/liquid, lotions, creams. |
| PEG-90M                | 25322-68-3  | PEG-90M   | Rita PEO-18        | Used in personal care products. Offers mildness, lubricity and film forming properties.             |
| Polymer | Functional Group/Compound | CAS No. | INCI name | Commercial name | Description as cosmetic ingredients. |
|---------|--------------------------|---------|-----------|-----------------|-------------------------------------|
| PEG-115M | PEG-115M ALKOX® E-240 | 25322-68-3 | Emollient and lubricant. Improves wet combing and provides skin conditioning, foam stability and retention. Used in shampoos, conditioners, soap bar/liquid, lotions and creams. |
| PEG-160M | PEG-160M Rita PEO-27 | 25322-68-3 | Used in personal care. Offers mildness, lubricity and film forming properties. |
| Cetyl PEG/PPG 10/1 Dimethicone | CETYL PEG/PPG-10/1 DIMETHICONE SeraSol® SC 83-E | Emulsifier for O/W emulsion, for multiple emulsions (W/O/W) and co-emulsifier for O/W emulsions. |
| Cetyl PEG/PPG-7/3 Dimethicone | CETYL PEG/PPG-7/3 DIMETHICONE SeraSol® SC 82 | Silicone emulsifier for O/W emulsions. Also works as a co-emulsifier for O/W emulsions & for multiple emulsions (W/O/W). |
| DIMETHICONE PEG/PPG-7/4 PHOSPHATE | DIMETHICONE PEG/PPG-7/4 PHOSPHATE Pecosil® WDS-100 | Allows for improved deposition of silicone onto skin and hair. |
| HYDROLYZED WHEAT PROTEIN/PEG-20 ACETATE COPOLYMER | HYDROLYZED WHEAT PROTEIN/PEG-20 ACETATE COPOLYMER Neopon® W-40 | It is the diester reaction product of hydrolyzed wheat protein and PEG-20 and is offered as a 40% solution in water. Optimize substantivity to hair. |
| Jojoba Oil PEG-150 Esters | JOJOBA OIL PEG-150 ESTERS FLORASOLVS® PEG-150 HYD JOJOBA | Bodifying agent, clarifying agent, co-emulsifying agent, emollient, film former, fragrance solubilizer, hair fixative, lubricant, plasticizer and solubilizing agent. |
| JOJOBA WAX PEG-120 ESTERS | JOJOBA WAX PEG-120 ESTERS FLORASOLVS® PEG-120 JOJOBA; Jojoba Aqua Sol PEG-120 | Bodifying agent, clarifying agent, cleansing agent, co-emulsifying agent, emollient, feel modification/enhancement, film former, fragrance solubilizer and hair fixative. |
| Jojoba Wax PEG-80 Esters | JOJOBA WAX PEG-80 ESTERS FLORASOLVS® PEG-80 JOJOBA | Bodifying agent, cleansing agent, co-emulsifying agent, emollient, feel modification/enhancement agent, fragrance solubilizer, lubricant and solubilizing agent. |
| Lauryl PEG/PPG-18/18 Methicone | LAURYL PEG/PPG-18/18 METHICONE Dow Coming® 5200 Formulation Aid | Used in skin care products such as protective cream, cleansing lotion, night cream, sunscreen cream, baby cream, dry skin cream and lotion and moisturizing cream. |
| Methoxy PEG-17/ Methoxy PEG-11/ HDI Isocyanurate Trimer Crosspolymer | POLYURETHANE-34 Baycusan® C 1005 | Filler. In rinse off and leave on products, it imparts a powdery velvety feeling to skin. |
| PEG/PPG-14/14 Dimethicone | SeraSol® SC 89 | Pro-foamer, O/W co-emulsifier, styling resin plasticizer, wetting agent, wet-conditioning agent and humectant. |
| Polymer/Group | Functional Compound | CAS No. | INCI name | Commercial name | Description as cosmetic ingredients. |
|---------------|---------------------|---------|-----------|----------------|-------------------------------------|
| PEG/PPG-15/15 Dimethicone | PEG/PPG-15/15 DIMETHICONE | Dow Coming® 5330 Fluid | Clear and opaque conditioning shampoos, rinse-off conditioners, leave-in conditioning treatments like detanglers, hair masques, mousses. |
| PEG/PPG-15/5 Dimethicone | PEG/PPG-15/5 DIMETHICONE | SeraSol® SC 91 | Pro-former, O/W co-emulsifier, styling resin plasticizer, wetting agent, wet-conditioning agent and humectant. |
| PEG/PPG-17/6 Copolymer | Ucon™ 75-H-450 | Moisturizing body lotions and eye make-up removers. Acts as an emollient, solvent and deposition agent. |
| PEG/PPG-18/18 Dimethicone | PCM-7919; BRB 523 | It is used in hair care formulations to add silkiness, shine, lubricity, and detangling. |
| PEG/PPG-20/15 Dimethicone | SF 118A | Used in personal care products such as hair sprays, hand lotion, antiperspirants, shaving aids and shampoos. |
| PEG/PPG-25/25 Dimethicone | Si-Tec™ DMC 6031 | Used in personal cleansing products, sun care and skin care. Possesses foam stabilizing, wetting, plasticizing and emulsification properties. |
| PEG/PPG-6/2 Glyceryl Cocoate | 72245-11-5 | Stepan® 745 GC | Conditioning agent, viscosity builder and emulsifier. It is a 100% active non-ionic liquid emollient. It is an alkoxylated derivative of glyceryl cocoate. |
| PEG/PPG-6/4 Dimethicone | PEG/PPG-6/4 DIMETHICONE | SeraSol® SC 90 | Pro-former, O/W co-emulsifier, styling resin plasticizer, wetting agent, wet-conditioning agent and humectant. |
| PEG-180/ Laureth-50/ TMG Copolymer | 373609-46-2 | PURE THIX® 1450 | Thickening, emulsifying agent, film former and humectant. |
| PEG-33/Adipic Acid/HMDA/ Glycol Copolymer (Proposed). | AXIOM ACT-33A | Effective hair conditioner. It is available in either non-ionic or mildly anionic form. |
| PPG-12-PEG-65 Lanolin Oil | 68648-38-4 | Ritalan AWS | Used in cosmetic formulations. Leaves a softer, smoother emollient film than other water soluble lanolins. |
| PPG-1-PEG-9 Lauryl Glycol Ether | 154248-98-3 | Eumulgin® L | Used in aqeous cosmetic preparations. Acts as a non-ionic O/W-emulsifier and/or solubiliser. |
| Wax PEG-3 Beeswax | 136097-93-3 | Hydrophilic derivative of natural beeswax. Used in cosmetic emulsions (o/w and w/o type), oil gel products and decorative cosmetics. Offers improved oil gelling and oil retention capability. |

The data were extracted from SpecialChem (http://cosmetics.specialchem.com/).
related to the general properties of its related mixtures, unless specific studies can be found. As much as we would like to know the specific effects of PEG/PPG-17/6 copolymer both in animal and human studies, we suggest that further evaluation should be needed if safety issues are found in its analogue mixtures. PEG/PPG-17/6 copolymer belongs to a group of copolymers of ethylene and propylene glycols with a variety of mixed names from a generic formula of “PPG-n-PEG-m”, where n and m signify their average respective monomer units bound to each other randomly. Non-random or block copolymers have specifically assigned denominations with rules that include “poloxamer”, “meroxapol” and “poloxamine” (9). Since very little is known about the specific properties of PEG/PPG-17/6 copolymer, the generic “poloxamer” will be described in this evaluation. Poloxamers follow a general formula, where x, y, z values depend on the mixture type (10). Poloxamers are water-soluble and can form gels in a concentrated aqueous solution, which is reversible to liquid form after lowering the temperature, and vice versa. Viscosity of poloxamers depends on the increasing percentages of polyoxypropylene hydrophobe and polyoxyethylene hydrophilic. As mentioned, PEG/PPG-17/6 copolymer could be under the umbrella of alkyl PEG-PPG ethers. This compound is produced from the reaction of an alkyl alcohol to any equivalents of both ethylene oxide and propylene oxide forming repeats in both PEG and PPG. Although these ethers are known to be surfactant-like molecules, having both hydrophobic and hydrophilic ends in their chain structures, they differ mainly in variations of their alkyl length, and the number of PEG and PPG repeat units in their hydrophobic ends. In each ingredient, the actual order of repeat units of alkoxides from different sources may be block, alternating, or random. PEG/PPG-17/6 copolymer is known to be of the random type. Specific physical properties of the alkyl PEG-PPG ethers are mostly unidentified, with only a known physical form of clear to slightly yellowish liquids (8). Furthermore, each ingredient/compound group is expected to have different properties.

Only the production of poloxamers is known, where generally it is an ordered mixture of propylene oxide, propylene glycol, and ethylene oxide prepared at high temperature and pressure along with an alkaline catalyst (e.g. sodium or potassium hydroxide), which becomes neutralized to become part of the final product (11). PEG/PPG-17/6 copolymer has been identified as a solvent in cosmetic products (12) as well as an emollient and surfactant (13).

Since no toxicity studies can be found for PEG/PPG-17/6 copolymer specifically, the general evaluations of its chemical analogue “poloxamers” are drawn. According to the Cosmetic Ingredient Review (CIR) expert panel, the presence of impurities during or after the process of mixing these compounds is of concern, including 1,4-dioxane, ethylene oxide, and propylene oxide, which are known to be carcinogenic and/or highly volatile. Thus, it was emphasized that purification of end mixtures before incorporation into cosmetic products should be carried out as a necessity in order to keep these impurities to very minimum levels of 1 ppm for 1,4-dioxane and 5 ppm for ethylene oxide and propylene oxide. In addition, toxicology studies for poloxamers suggested “a low order of toxicity” in all acute to chronic animal testing, including the negative results for genotoxicity and carcinogenicity studies. No reproductive or developmental toxicity studies have been conducted thus far. In both animal and human testing, poloxamers were not dermally irritating or sensitizing. Finally, poloxamers are considered as safe for cosmetic use according to the current concentrations applied, and according to the manufacturers’ ability to remove their impurities (8). Accordingly, PEG/PPG-17/6 copolymer may have the same properties and effects as long as impurities are kept acceptably low. However, a more specific assessment for this ingredient is highly recommended to draw indubitable conclusions for the safety of its use in cosmetics.

**PEG-20 glyceryl triisostearate.** PEG-20 glyceryl triisostearate is a nonionic compound with a molecular weight of more than 1,000, and is used as an emulsifier, dispersing agent, and solubilizing agent in cosmetics and personal care products. It is mainly used in both rinse-off cleansing products such as facial cleansers or body washes and leave-on products such as creams or lotions. The cleansing and leave-on products contain this chemical up to 20% and 5%, respectively. PEG-20 glyceryl triisostearate is probably removed from the water up to 90% by partitioning to solids during water treatment processes. PEG-20 glyceryl triisostearate is not expected to bioaccumulate due to its high molecular weight and is not anticipated to cross biological membranes (14).

The exposure route of PEG-20 glyceryl triisostearate may be dermal, and the dermal exposure to the notified polymer is expected to be extensive due to daily application of PEG-20 glyceryl triisostearate-containing cosmetic products. Thus, the exposure to PEG-20 glyceryl triisostearate for the public is expected to be widespread and frequent through the daily application of cosmetics (14). In spite of the widespread use of PEG-20 glyceryl triisostearate, the previous safety assessment of this chemical for humans was still not sufficient. Thus, this report provides the toxicological evaluation of PEG-20 glyceryl triisostearate as a cosmetic ingredient. The toxicological data of PEG-20 glyceryl triisostearate were estimated based on its chemical analogues including glyceryl triisostearate, sorbitan sesquioleate, and PEG-20 sorbitan fatty acid esters (Table 2) (15-17). Although these chemicals do not contain all of the functional groups present in PEG-20 glyceryl triisostearate, some properties of PEG-20 glyceryl triisostearate can be approximated using the component chemicals. Acute oral
toxicity of the PEG-20 glyceryl trisostearate is expected to have LD_{50} of more than 2,000 mg/kg bw. Furthermore, skin irritation and sensitization testing of PEG-20 glyceryl trisostearate is expected to be negative or weak. Indeed, there was no evidence of sensitization in the repeat insult patch test. Eye irritation and mutagenicity of this compound was not be observed. The main route of exposure to PEG-20 glyceryl trisostearate is expected to be dermal during application of cosmetics and personal care products. Interestingly, the high molecular weight and low water solubility of PEG-20 glyceryl trisostearate could inhibit its absorption through various routes including dermal, inhalation, and oral (14). Hence, based on the overall studies, PEG-20 glyceryl trisostearate would not be threatening nor toxic to consumers’ health.

**PEG-40 hydrogenated castor oil.** PEG-40 hydrogenated castor oil, as the name implies, is a hydrogenated castor oil-derived PEG with an average of 40 moles ethylene oxide. It is mixed through the etherification and esterification of hydrogenated castor oil glyceride and fatty acid products, having forty equivalents of ethylene oxide (18). PEG-40 hydrogenated castor oil (trade name: Cremophor RH 40) is utilized as a non-ionic solubilizer and emulsifying agent. It had been used to solubilize many cosmetic products including ethereal oils, perfume compositions, vitamins, and hydrophobic active substances in aqueous and/or alcoholic solutions. The identified concentrations of PEG-40 hydrogenated castor oil in products are in the range of 0.00007% to 22%, in which the maximum known concentration of 22% is contained in leave-on products (19).

There were few toxicological assessment data available for this specific compound. A patch test was conducted on 20 human volunteers using 100% concentration of PEG-40 hydrogenated castor oil on the skin of the back area and observed after 24 and 48 hrs. No further details were stated, however no sign of irritation was concluded. Nevertheless, another single patch test using only 0.25% PEG-40 hydrogenated castor oil as part of a formulation showed a mild reaction in 1 out of 20 human volunteers, which could be related to other ingredients in the formulation or an isolated hypersensitivity case (Table 2) (20).

### Table 2. Toxicological data of PEG compounds

| Chemical compound                          | Studies                  | Animal          | Result                        | Ref.   |
|-------------------------------------------|--------------------------|-----------------|-------------------------------|--------|
| Glyceryl trisostearate                    | Acute oral toxicity      | Rat             | LD_{50} > 2 g/kg bw           | (16)   |
|                                           | Skin irritation          | Rabbit          | Non-irritant                  |        |
|                                           | Skin sensitization       | Guinea pig      | Non-sensitizing               |        |
|                                           | Eye irritation           | Rabbit          | Non-irritant                  |        |
|                                           | Mutagenicity             | Rabbit          | Not mutagenic                 |        |
| Sorbitan sesquiisostearate                | Acute oral toxicity      | Rat             | LD_{50} > 25 g/kg bw          | (17)   |
|                                           | Skin irritation          | Guinea pig      | Weak irritant                 |        |
|                                           | Repeat insult patch test | Human           | Non-sensitizing               |        |
|                                           | Eye irritation           | Rabbit          | Mild irritant                 |        |
|                                           | Mutagenicity             | Rabbit          | No data available             |        |
| PEG-20 sorbitan fatty acid esters         | Acute oral toxicity      | Rat             | LD_{50} > 2 g/kg bw           | (15)   |
|                                           | Skin irritation          | Rabbit          | Non-irritant                  |        |
|                                           | Repeat insult patch test | Human           | Non-sensitizing               |        |
|                                           | Eye irritation           | Rabbit          | Mild irritant                 |        |
|                                           | Mutagenicity             | Rabbit          | Not mutagenic                 |        |
| PEG-40 Hydrogenated Castor Oil            | Acute toxicity           | Rat             | LD_{50} > 15.0 g/kg           | (23)   |
|                                           | Subchronic toxicity      | Rat             | No signs of abnormalities     | (19)   |
|                                           | Sensitization test       | Human           | Non-sensitizing effect        | (20,23,29) |
|                                           | Dermal studies           | Rat             | No microscopic changes        | (24)   |
|                                           | Skin irritation          | Mouse, Rat      | No signs of irritation         | (25,31) |
|                                           | Reproductive and teratogenicity | Rat | No significant maternal or fetal toxicity effects | (19)   |
| PEG-60 Hydrogenated Castor Oil            | Acute toxicity           | Rat             | LD_{50} > 5 g/kg              | (26)   |
|                                           | Sensitization test       | Human           | No sign of irritation          | (27)   |
|                                           | Ocular irritation        | Rabbit          | Minimal irritation            | (28)   |
|                                           | Dermal studies           | Rat             | The change within the normal range | (29)   |
|                                           | Genotoxicity             | Mouse           | No signs of toxicity          | (30)   |
subject through occlusive patching on Mondays, Wednesdays, and Fridays of the 3-week testing period. Challenge patching was carried out on previously untreated sites after a 2-week non-treatment period. Observations of the treated sites showed one incident of almost imperceptible erythema among 5 subjects during the induction phase of the study, while one of these subjects showed a mild reaction during 24 and 48 hrs of the challenge patching. Another subject who did not show a reaction during the induction test also showed an almost imperceptible erythema during the challenge test. Follow-up testing of the 2 subjects who showed a reaction during the challenge test showed lesser reactions in which clinical significance could not be concluded. Thus, the overall findings of the study established a non-sensitizing effect of PEG-40 hydrogenated castor oil (Table 2) (29). A similar study using a higher concentration of PEG-40 hydrogenated castor oil at 0.25% in a formulation was tested in 86 subjects. During the induction testing, 2 subjects showed a mild reaction but not during challenge testing. One subject who did not show a reaction in the induction testing showed a faint erythema only at the 24 hr grading period. Results could not conclude a sensitizing effect of the chemical at this concentration (Table 2) (23).

PEG-40 hydrogenated castor oil was also investigated for its sub-chronic treatment toxicity potential in animals. The first experiment was investigated in Sprague-Dawley (S-D) rats given an oral feed containing 0 (control), 10,000, 32,000, and 64,000 ppm of PEG-40 hydrogenated castor oil (20 males and 20 females in each group except 10,000, which had 25 animals of each gender). All animals survived during the experiment period and no significant feeding, body weight, or hematological changes were observed in any group. Necropsy further revealed no signs of abnormalities in the internal body components. In another study, a 6-month feeding period for PEG-40 hydrogenated castor oil was conducted in 3 male and 3 female beagle dogs using 0 (control), 1%, 2.5%, and 5.0% concentrations. Observations during the study showed no significant changes in behavior, feeding, or body weight. Hematological and other biochemical parameters were of the same levels as the control group. One low-dose-treated animal died for reasons unrelated to the treatment. Necropsy further supported no evidence of toxicity in the feeding study (Table 2) (19).

Dermal studies for PEG-40 hydrogenated castor oil, contained at a concentration of 0.25% in a formulation, were conducted in 10 male and 10 female S-D rats through daily applications, 5 days a week for 13 consecutive weeks. The formulation was given at 1,640 mg/kg/day, which was believed to be 100 times greater than the average daily use by human consumers. During the entire duration of the study, all rats survived and no abnormal changes in behavior, body weight, hematology, urinalysis or chemical chemistry parameters were reported. In contrast, mild skin irritation at the treated site was observed starting on day 5 until the end of the study, as well as a significant elevation in hepatic weights in male rats when compared with the controls. Nevertheless, the finding was not considered relevant for toxicology since no microscopic changes were observed (Table 2) (24).

Skin irritation studies for PEG-40 hydrogenated castor oil contained at a concentration of 20% in a micro-emulsion were conducted in mice. The application site was the left ear that was given a single dose of 10 μl of the material, while the right ear served as a control. During the 6 days observation, no signs of irritation could be seen in the treated ear with a 20% concentration of PEG-40 hydrogenated castor oil (Table 2) (25). Another dermal irritation test using 20.66% PEG-40 hydrogenated castor oil, contained in a micro-emulsion gel, was conducted in male albino rats using the Draize method. Treated groups were given 0.5 g of the formulation, for 3 consecutive days, in a 5 cm² dorsal side shaved skin area. A negative (no treatment) and a positive (0.8% aq. formalin) control group was present. During the 3 days of observation, no signs of skin irritation could be seen for the test material, and the histopathological exam yielded negative skin irritation results (Table 2) (31).

Feeding studies for the assessment of reproductive and teratogenic effects of PEG-40 hydrogenated castor oil were conducted in pregnant S-D rats. One group (30 rats) was given 50,000 ppm and another 27 rats were given 100,000-ppm PEG-40 hydrogenated castor oil from gestational day 0 to gestational day 20, while another 2 groups of untreated control were raised. Pregnant animals were monitored and assessed for signs of toxicity during gestation, and were sacrificed at gestational day 20 for fetal examination. Examinations of the mother and fetuses did not reveal any signs of toxicity. Although resorption and malformations/anomalies were found in some animals in the highest dose group, similar changes were also found in the control group, showing no significant differences. Thus, the researchers conducting the study could not conclude teratogenicity for PEG-40 hydrogenated castor oil. Studies were also conducted in 4 groups of pregnant NMRI mice using 5,000 ppm (25 mice) and 10,000 ppm (31 mice) PEG-40 hydrogenated castor oil from day 6 to 15 of gestation; the other 2 groups were raised as controls. During the study, no significant maternal or fetal toxicity effects were found, and some malformations in fetuses in the treated groups were also comparable to the control groups (Table 2) (19).

**PEG-60 hydrogenated castor oil.** PEG-60 hydrogenated castor oil is a hydrogenated castor oil-derived polyethylene glycol with an average of 60 moles ethylene oxide. It is mixed through the etherification and esterification of hydrogenated castor oil glyceride and fatty acid products, having sixty equivalents of ethylene oxide. PEG-60 hydrogenated castor oils had 349 reported uses (with a similar
function to PEG-40 hydrogenated castor oil) by the time of the CIR panel meeting. Their uses are expected to increase in the following years. The identified concentrations of PEG-60 hydrogenated castor oil in products are in the range of 0.00004% to 18%, in which the maximum known concentration of 18% is contained in leave-in non-coloring hair products (18).

From the clinical reports of PEG-60 hydrogenated castor oil, a 27-year-old male patient with acute myeloblastic leukemia, receiving chemotherapy containing enocitabine, developed a high-grade fever and erythroblastopenia 6 hours after intravenous administration. PEG-60 hydrogenated castor oil was present in the enocitabine. A follow-up study evaluation of dosing enocitabine alone showed similar symptoms. When the patient’s bone marrow was co-cultured with enocitabine or PEG-60 hydrogenated castor oil, significant growth inhibition of late erythroid progenitors was observed with the patient’s IgG present. The researchers suggested that the immunological suppression effects of PEG-60 hydrogenated castor oil could be due to its hapten effect on the hypersensitive reaction of the patient’s IgG (18). In another study, a 21-consecutive-day occlusive patch test was conducted for PEG-60 hydrogenated castor oil, with a 3% concentration in a formulation, in 12 human volunteers. Interestingly, the test concluded the formulation to be non-irritating (21). Thus, PEG-60 hydrogenated castor oil, when given according to the regulated dose, should be non-irritating to healthy consumers, while caution should be observed for individuals with immunosuppression or autoimmune syndromes.

Acute toxicity studies were conducted for PEG-60 hydrogenated castor oil in various animals including male and female Beagle dogs, male and female cynomolagus monkeys, male New Zealand white rabbits, male Hartley guinea pigs, and male S-D rats. Overall results showed systemic and irritant effects only in dogs, and not in the other animals tested, indicating species-specific effects (22).

Sub-chronic dermal toxicity studies of PEG-60 hydrogenated castor oil were conducted in 10 female ChR-CD rats through daily topical applications (5 times a week for 13 weeks) of 284 or 2,840 mg/kg of a formulation containing 3.0% PEG-60 hydrogenated castor oil. Treated sites showed slight erythema and dryness, but this was seen in both the experimental and control groups. Necropsy did not find any lesions, however significant hepatic weight and renal-to-body ratio changes were observed. Nevertheless, these changes were within the normal range of laboratory parameters, and no further histopathological changes were noted (Table 2) (29).

A sensitization study (similar methods to PEG-40 hydrogenated castor oil) in 102 human subjects with 3.0% PEG-60 hydrogenated castor oil formulation showed no sign of irritation in the subjects during the induction phase. During the challenge phase, only a doubtful reaction in one subject was observed after 48 hrs of testing, which further showed negative results for sensitization during a follow-up test (Table 2) (27).

Genotoxicity studies were conducted for PEG-60 hydrogenated castor oil using a reverse mutation test in the Salmonella typhimurium strains TA100, TA98, TA1535, and TA1537, and in Escherichia coli strain WP2uvrA, with and without metabolic activation. Concentrations of the material tested ranged from 313 to 5,000 µg/plate, and positive controls were used including 9-aminocaridine, sodium azide, 2-(2-furyl)-3-(5-nitro-2-furyl)-acrylamide, and 2-aminooantracene. Results showed no significant increase in revertant colony numbers at all concentrations, test strains, and metabolic conditions using PEG-60 hydrogenated castor oil, whereas genotoxic results were found in the positive controls. A chromosome aberration study was also conducted in Chinese hamster V79 cells using the same concentrations as mentioned above. Mitomycin C and dimethylnitrosamine were used as positive controls. Results showed a dose-dependent cell proliferation inhibition in the “without metabolic activation conditions” 24-48 hrs after treatment. The test material with metabolic activation showed only slight cell proliferation inhibition 6 hours after treatment, even at the highest dose. Overall, PEG-60 hydrogenated castor oil did not show chromosome aberrations under the experimental conditions, and it was concluded that the material was not genotoxic. Similar studies on the mouse micronucleus of 5 male and 5 female BDF1 mice were conducted by giving single intraperitoneal injections of 2,000 mg/kg bw dosage of PEG-60 hydrogenated castor oil to experimental groups, and saline or mitomycin C to the control groups. Bone marrow cells collected at 24, 48, and 72 hrs post-treatment showed no relevant changes in micronucleated polychromatic or normochromatic erythrocytes. No signs of toxicity were observed, further supporting its non-genotoxic properties (Table 2) (30).

An ocular irritation test was also conducted for a 3.0% PEG-60 hydrogenated castor oil formulation, which caused minimal irritation to the eyes in 2 out of 6 rabbits tested after instillation. After 48 hrs, all signs had disappeared (Table 2) (28).

CONCLUSIONS

PEGs have a wide variety of PEG-derived mixtures due to their readily linkable terminal primary hydroxyl groups in combination with many possible compounds and complexes such as ethers, fatty acids, castor oils, amines, propylene glycols, among other derivatives. PEGs and their derivatives are broadly utilized in cosmetic products as surfactants, emulsifiers, cleansing agents, humectants, and skin conditioners. However, studies are lacking concerning those specific PEG-derived mixtures that we have evaluated in this review. Little is known about PEG/PPG-17/6 copoly-
mer and PEG-20 glyceryl trisostearate, while some studies are available for PEG-40 hydrogenated castor oil and PEG-60 hydrogenated castor oil as PEGylated oils, regarding their safety and toxicity in humans and animals. Reviews were mostly carried out on the general compound, with details in a few individual studies. Nevertheless, the present review summarizes the results of the known toxicity studies of these compounds in focus (Table 2).

PEG/PPG-17/6 copolymer has particularly little toxicological information, thus further investigation is obviously needed for it to be continually utilized in cosmetics and other products with human exposure. PEG-20 glyceryl trisostearate-related studies have shown an LD₅₀ of > 2,000 mg/kg bw in rat acute oral studies. Furthermore, this compound was observed to be non-irritating to rabbit skin and eyes, non-sensitizing to guinea pig skin, and non-mutagenic (further details unknown). Both PEG-40 and PRG-60 hydrogenated castor oils were generally non-irritating and non-sensitizing to human skin up to 100% concentration. This was also supported by animal studies. Intravenous exposure to PEG-60 hydrogenated castor oil may cause hypersensitive or further immunosuppressive effects as found in a leukemia patient undergoing chemotherapy. Nevertheless, acute intravenous administration of PEG-60 hydrogenated castor oil to various animal species generally did not show toxic effects up to the highest administered dose of 100 mg/kg. However, Beagle dogs showed some reactions that may show species-specific effects of PEG-60 hydrogenated castor oil. Repeated-dose toxicity with PEG-40 hydrogenated castor oil in both S-D rats and Beagle dogs did not show toxic effects up to 64,000-ppm and 5.0% dosage concentrations, respectively. Acute oral toxicity studies in rats of both PEG-40 and PEG-60 hydrogenated castor oils have shown LD₅₀ values of 0.25% at 15.0 g/kg and 3.0% at 5.0 g/kg, respectively. Sub-chronic dermal exposure of both mixtures to rats (0.25% PEG-40 and 0.3% PEG-60 hydrogenated castor oils) showed slight erythema (as well as in the controls), but did not cause any toxic effects. PEG-60 hydrogenated castor oil showed minimal eye irritation. PEG-60 hydrogenated castor oil was not genotoxic in bacteria or mammalian cells. Thus, these related PEGylated oils were concluded as safe for use in cosmetics according to regulating bodies and reviews found in this evaluation.

Unfortunately, no reliable safety or toxicity studies could be found for other PEG derivatives being evaluated in this review. Nevertheless, PEGs and PEG derivatives were generally regulated as safe for use in cosmetics, with the conditions that impurities and by-products, such as ethylene oxides and 1,4-dioxane, which are known carcinogenic materials, should be removed before they are mixed in cosmetic formulations. Ultimately, specific assessment studies for each chemical mixture are prompted for the exact evaluation of their safety in cosmetic use.

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