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Cosmetics — Answers to frequently asked questions on ingredients and product characterization according to ISO 16128-1 and ISO 16128-2

Cosmétiques — Réponses aux questions fréquemment posées sur la caractérisation des ingrédients et des produits conformément à l'ISO 16128-1 et à l'ISO 16128-2

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 217, *Cosmetics*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO 16128 series provides guidelines on definitions and criteria for natural and organic cosmetic ingredients and products. These guidelines are specific to the cosmetics sector, taking into account that most existing approaches written for the agricultural and food sector are not directly transferrable to cosmetics. They apply scientific judgment and offer principles towards a consistent logical framework for natural and organic cosmetic ingredients and products incorporating common approaches employed in existing references.

The purpose of the ISO 16128 series is to encourage a wider choice of natural and organic ingredients in the formulation of a diverse variety of cosmetic products to encourage innovation.

The purpose of this document is to help ingredient manufacturers and cosmetic companies, or any reader, to qualify cosmetic ingredients as natural, natural derived or non-natural when using the ISO 16128 series.

Cosmetics — Answers to frequently asked questions on ingredients and product characterization according to ISO 16128-1 and ISO 16128-2

1 Scope

This document provides answers to questions which can arise when calculating indexes and contents according to ISO 16128-1 and ISO 16128-2.

It clarifies conditions on process, solvents and carbon sources to qualify ingredients regarding the ISO 16128 series. Detailed examples, explaining how to use the ISO 16128 series are also provided.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Questions and answers

4.1 General

Table 1 — General questions

No.	Question	Answer
0	How can an ingredient manufacturer and/or a cosmetic manufacturer assign the category and index of an ingredient?	Ingredient manufacturers are recommended to provide cosmetic manufacturers with information related to composition, origin and processing of ingredients to determine ingredient indexes. For all ingredients, cosmetic manufacturers verify the category and index based on information provided. Therefore, dialogue between ingredient and cosmetic manufacturers is encouraged.
1	What are the differences between the following terms: ingredient, substance, raw material, and renewable material?	A cosmetic raw material is an ingredient or a mixture of ingredients. An ingredient is a substance, i.e. a chemical element and its compounds in the natural state or the result of a manufacturing process, excluding any solvent which may be separated without affecting the stability of the substance or changing its composition. Certain substances are renewable if they are replenished naturally at a rate at least the same as their consumption.
2	How does the definition of an extract relate to its INCI composition?	An extract is a substance or a mixture of substances. In most cases, its INCI name is the same as the natural ingredient it comes from, with, when relevant, the INCI name(s) of the ingredient solvent(s) used for extraction.

Table 1 *(continued)*

No.	Question	Answer
3	Can the INCI ingredient lists be used to determine if a product is natural, derived natural or non-natural?	No. More information is needed to make that determination. INCI ingredients can be produced in different ways and process solvents used will not appear in the INCI ingredients list. For example, it is possible to have two products with the exact same INCI names list be classified differently when using the methods set out in ISO 16128-1.
4	How do the different categories of solvents relate to their INCI nomenclature?	ISO 16128-1 refers to two categories of solvents: ingredient solvents and process solvents, which are defined in ISO 16128-1:2016, Annex A. Ingredient solvents appear in the INCI ingredients list. Process solvents do not remain in the ingredient (except as traces) and will not appear in the INCI ingredient list.

4.2 Natural ingredients

Per ISO 16128-1, natural ingredients are cosmetic ingredients obtained only from plants, animals, micro-organisms, or minerals, including those obtained from these materials by:

— physical processes (e.g. as grinding, drying, distillation);

— fermentation reactions occurring in nature and leading to molecules occurring in nature; and

— other processes of preparation, including traditional ones (e.g. extraction using solvents) without intentional chemical modification.

See Table 2.

Table 2 — Questions on natural ingredients

No.	Question	Answer
5	How is water defined in ISO 16128-1?	Water is defined as always natural in ISO 16128-1:2016, 2.4.
6	The definition of water of crystallization is not provided in ISO 16128-1. How is it defined?	In chemistry, water of crystallization is water molecules that are present inside crystals of minerals. It can be considered as constitutive water in natural minerals. In the cases which water is either added during or produced after a reaction, it is considered as formulation water.
7	How is aromatic water obtained by distillation classified in ISO 16128-1?	It is classified as extraction water.
8	Are ingredients such as ethanol, amino acids, or nucleic acids considered natural if obtained by fermentation reaction using a substance occurring in nature as a starting material?	Yes. As long as the feedstock is natural, the reaction fermentation occurs in nature and the fermentation product is one that occurs in nature, the result is natural.
9	Can Formula (1) in ISO 16128-2:2017, 4.3.1 be used to calculate the natural index of an ingredient that does not contain ingredient solvents?	Formula (1) in ISO 16128-2:2017, 4 3 1 is used only for extracts when ingredient solvents are present. Otherwise, the natural index is assigned, according to the same paragraph, is either 1 or 0.
10	Aromatic natural raw materials are defined according to ISO 9235. How are the indexes of aromatic natural raw materials calculated per ISO 16128?	"Fragrance/Parfum" are often mixtures including aromatic natural materials. The calculation of indexes of all ingredients containing aromatic natural raw materials follows ISO 16128. The exact composition, according to ISO 16128-1, can be obtained from the suppliers.

4.3 Physical processes for natural ingredients

Table 3 — Questions on physical processes for natural ingredients

No.	Question	Answer
11	Can "processing by micro-waves" be considered as physical process?	Yes. Any sort of drying process can be considered as physical process if it does not lead to chemical modification.
12	Are new technologies for physical extraction considered as physical extraction process?	Yes, new technologies, such as use of micro-waves, sonication and ultrasounds can be considered, as long as there is no chemical modification. The use of solvents is defined in ISO 16128-1:2016 Table A.1.
13	In case of a plant extract extracted with a mixture consisting of a non-natural solvent and a natural solvent, is the final extract considered as a natural ingredient?	If a non-natural solvent remains in the final extract as an ingredient solvent, this extract is considered as a non-natural ingredient. If the non-natural solvent is eliminated, this extract can be considered as a natural ingredient if conditions of ISO 16128-1:2016, Table A.2 are fulfilled.
14	The value k is the dry/fresh ratio for leaves or flowers when calculating natural/organic index of plant extract. If a supplier can specify the actual dry/fresh ratio and it is different from k value, can the specified values be used for calculation?	Yes.
15	Provide index calculation examples for the extract of a dried organic plant.	EXAMPLE 5 kg of dry plant (organic flower) was extracted by 90 kg of 30 % glycerin (a derived natural solvent) aqueous solution was obtained. (k=4,5) — Starting materials: 5 kg of dry plant is equivalent to 5 × 4,5 = 22,5 kg of fresh plant — Solvent: 63 kg of water, 27 kg of glycerin — Reconstitution water: 22,5 – 5 = 17,5 kg — Extraction water: 63 – 17,5 = 45,5 kg NOTE Extraction water is as defined in ISO 16128-1. Natural index of the extract: 1 – (27/(5 + 63 + 27)) = 0,71 Natural origin index of the extract: 1 as all ingredients meet the definition of derived natural ingredients Organic index of the extract: 1 – ((45,5+27)/ (5+63+27)) = 0,24 Organic derived index of the extract: 1 – ((45,5 + 27)/ (5 + 63 + 27)) = 0,24
16	According to ISO 16128-2:2017, 4.2: "*The use of non-natural ingredients (e.g. alcohol denaturants) is allowed in ingredient solvent. However, if the mixture contains a non-natural ingredient solvent, then the entire mixture is non-natural.*" Does it mean, for example, that the addition of phenoxyethanol to an extract is OK and only affects the index value, but if an extraction solvent of butylene glycol (non-natural) is used, then the index is 0, regardless? At what value does an added ingredient become a solvent (i.e. polysorbate-80) or does the definition refer only to extraction solvents?	The bullet from ISO 16128-2:2017, 4.2 stating that the use of non-natural ingredients (e.g. alcohol denaturants) is allowed in ingredient solvents means, for example, that denaturated alcohol can be used for extraction and leads to a natural extract. When phenoxyethanol is added to an extract after filtration, this is a mixture which has no longer an index but instead has a content. The use of butylene glycol (non-natural) as an extraction solvent leads to a non-natural ingredient. The use of polysorbate 80 during an extraction leads to a non-natural ingredient as it is not of natural origin. But its use after filtration leads to a mixture which has a content.

Table 3 *(continued)*

No.	Question	Answer
17	Is a dry herbal extract or a purified compound isolated from a natural source considered as a natural ingredient?	In the extent that solvents do not remain in the final ingredients except as traces (process solvents), they are considered as natural ingredients according to ISO 16128-1:2016, Table A.2 if: — renewable solvents that pose minimal safety or environmental risk are used; or — if no physical process or no renewable solvent can be used, a non-natural solvent that poses minimal safety or environmental risk is used.
18	What are the indexes of a rose extract, obtained by extraction with a mixture of water and butylene glycol, if the butylene glycol is of petrochemical origin?	As the butylene glycol is of petrochemical origin, it is a non-natural ingredient solvent. The rose extract is a non-natural ingredient. Both natural index and natural origin index are 0.
19	What are the indexes of a rose extract, obtained by extraction with a mixture of water and butylene glycol, if the butelyne glycol is of vegetal origin?	As the butylene glycol is a derived natural ingredient solvent, the natural index is determined using Formula (1) in ISO 16128-2:2017, 4.3.1. Starting material: 10 kg of flower Total solvent introduced: 90 kg = 67,5 kg water + 22,5 kg butylene glycol Mass of derived natural solvent introduced = 22,5 kg butylene glycol Total mass introduced (natural ingredients and ingredient solvents) = 10 + 67,5 + 22,5 = 100 kg The natural index is = 1 – (22,5/100) = 0,775 The natural origin index is 1.
20	Is native guar gum a natural ingredient? According to a February 2010 Opinion from AFSSA (ref. 2009-SA-0214), guar gum is obtained, using Cyamopsis tetragonolobus seeds through traditional methods in the grain milling industry. Guar gum is obtained through the following process: — seeds extracted from dried pods are mechanically broken down in order to eliminate the sprout; — the endosperm is husked to obtain flakes; — flakes are ground then sieved to obtain a powder; — powder or flakes are washed using ethanol or isopropanol to limit the microbial load.	Yes, the process of native guar gum used here is a physical separation of the molecules present in the seeds. The natural index of the native guar gum is 1, if process solvents used respect the natural category of ISO 16128-1:2016, Table A.2.
21	How is an extract from cell culture medium defined in ISO 16128? For example, an Aloe barbadensis Callus extract is an extract obtained through the culture of Aloe barbadensis Callus.	The culture and extraction of a plant callus is carried out in a medium. The natural index and the natural origin index depend on the composition of the medium as defined in ISO 16128-1. None of the ingredients are organically produced. OI=OOI =0

4.4 Fermentation for natural ingredients

Table 4 — Questions on fermentation for natural ingredients

No.	Question	Answer
22	What is fermentation?	Fermentation reactions result from a culture medium containing micro-organisms, including bacteria, yeasts or moulds. According to the definition of ISO 16128-1:2016 "fermentation" also includes reactions generated by micro-algae or plant cells.
23	What are the conditions for a fermentation process to obtain a natural ingredient?	For a fermentation process to obtain a natural ingredient, the process exists in nature, uses a natural substance as a starting material and leads to molecules which occur in nature.
24	What type of carbon sources can be used to obtain a natural ingredient?	The carbon source (substrate) for the fermentation process can be a natural ingredient or mixture of natural ingredients (sucrose for instance). See NOTE 1.
25	Are citrate salts natural?	Yes, if the substrate is natural (e.g. Beetroot syrup) and as far as the ferment: Aspergillus niger naturally produces some citrate salt, the salt resulting from the fermentation with Aspergillus niger and the natural substrate (as carbon source) is natural.
26	Which type of modifications can be considered for microorganisms?	Selecting or cross-breeding native micro-organisms can be considered to obtain natural ingredients. See NOTE 2.
27	How are adjuvant in the culture medium treated?	Traces of adjuvant from the culture medium in the finished product are treated as process solvents. Adjuvant of fossil origin can be considered provided there is no alternative.
28	Is industrial fermentation considered to be a biological process?	Ingredients manufactured by industrial fermentation are considered as natural ingredients, if the following points are fulfilled, even if it is intentionally manufactured: 1) using a natural substance as a starting material; 2) by a fermentation reaction which exist in nature; 3) leading to molecules which occur in nature. Ethanol for instance is natural when a native micro-organism is used and when the carbon source is a natural ingredient such as saccharose. See NOTE 2.
29	Is Xanthan gum a natural or derived natural ingredient? How are the indexes determined?	Xanthan gum is obtained through the fermentation of a non-genetically modified bacterium (Xanthomonas campestris) using a carbohydrate substrate (corn or soy starch). Xanthan occurs in nature, produced by micro-organisms living in soils. As this is an ingredient - and not a mixture - indexes are calculated, based on quantities used. NI = 1 and NOI = 1 See NOTE 2.
NOTE 1 The fermentation substrate is natural in order to obtain a natural ingredient. This requirement is consistent with ISO 16128-1:2016, Table A.1. NOTE 2 Ingredients obtained by fermentation using genetically modified microorganisms can be considered as natural ingredients in certain regions of the world and derived natural ingredients in other regions of the world.		

4.5 Process solvents

Table 5 — Questions on process solvents

No.	Question	Answer
30	Can supercritical CO_2 extraction be considered for obtaining natural ingredients?	Yes, supercritical CO_2 is one of the process solvents which can be used to obtain a natural ingredient.
31	Can non-renewable solvents be used for extraction?	As process solvents of natural ingredients, natural mineral ingredients, derived natural ingredients and derived mineral ingredients, renewable solvents that pose minimal safety or environmental risk are used for the purpose of extraction or reaction processes. If renewable alternatives are not available, non-natural solvents that pose minimal safety or environmental risk can be used, per ISO 16128-1:2016, Table A.2
32	Are vegetable oils and animal oils considered as natural ingredients?	Yes, if they meet the definition of natural per ISO 16128-1:2016, Clause 2. Those manufactured by physically process such as squeezing are considered as natural ingredients. For those extracted with solvents, in case those solvents remain in the final ingredients (ingredient solvents), it depends on the origin of the solvents. ISO 16128-1:2016, Table A.1 is to be used for verification. In case solvents do not remain in the final ingredients except as traces (process solvents), they are considered as natural ingredients according to ISO 16128-1:2016, Table A.2 if: — renewable solvents that pose minimal safety or environmental risk are used; or — no physical process or no renewable solvent can be used, a non-natural solvent that poses minimal safety or environmental risk is used.
33	For the manufacturing of lecithin, hexane is commonly used as process solvent. Does it impair the classification of lecithin as natural due to its petrochemical origin?	As the use of hexane for the manufacturing of lecithin is unavoidable at the current state of art, according to ISO 16128-1:2016 Table A.2 footnote “a”, the classification of lecithin is not affected by the use of hexane. Hexane concentration in the final lecithin has to pose minimal safety or environmental risk.

4.6 Mineral ingredients

Table 6 — Questions on mineral ingredients

No.	Question	Answer
34	Does ISO 16128-1:2016, Annex D contain natural minerals?	Yes. ISO 16128-1:2016, Annex D is an illustrative, not exhaustive, list of reaction products that may be considered derived mineral ingredients. Ingredients on this list which are found in nature (i.e. not chemical reaction products) are natural mineral ingredients.
35	Is surface-coated titanium dioxide a non-natural ingredient?	When physically coated by encapsulation or electrostatic surface modification, it is considered as a mixture of titanium dioxide and coating agent. The titanium dioxide may be considered as a derived mineral ingredient. The natural and natural origin indexes of the coating are to be determined separately. When chemically modified with a natural (except natural mineral ingredient) or derived natural reactant that makes up less than or equal to 50 % by weight of the ingredient, as a surface coating or otherwise, the result is a non-natural ingredient. When reacted with a natural (except natural mineral ingredient) or derived natural reactant that makes up greater than 50 % by weight of the ingredient, as a surface coating or otherwise, the result is a derived natural ingredient. In either case, when chemically modified with non-mineral ingredients, the result is not considered as a derived mineral ingredient.
36	Is nano-sized titanium dioxide, considered as a derived mineral ingredient, as long as it has the same chemical composition as a natural mineral ingredient?	Since the properties other than the chemical composition, such as crystal structure and physical properties, are not specified in the definition of derived mineral ingredient, it may be considered as a derived mineral ingredient, as long as the chemical composition is the same as a natural mineral ingredient and as long as it respects the full definition of ISO 16128-1:2016, Clause 4, including process information.
37	What is the classification for KOH (potassium hydroxide), derived mineral or non-natural?	KOH is not found in nature, so it is non-natural and cannot be derived mineral.
38	Can cosmetic grade iron oxides be considered derived natural ingredients?	Since they are from mineral rather than biological origin, iron oxides are not considered derived natural ingredients. If they meet the criteria, then cosmetic grade iron oxides are derived mineral ingredients and contribute to natural origin content of a product.
39	Can fumed silica be claimed derived mineral?	Silica is a natural mineral. Fumed silica which has the same composition as silica, may be classified as a derived mineral ingredient. It is obtained through chemical processing of inorganic substances occurring naturally in earth, which have the same chemical composition of natural mineral ingredients.
40	When a natural mineral ingredient is reacted with other ingredients, what is natural origin index of the ingredient?	If it has the same chemical composition as a natural mineral ingredient, it is considered as a derived mineral ingredient. If it doesn't have the same chemical composition as natural mineral ingredients and is greater than 50 % natural origin, then that portion of ingredient can contribute to the natural origin index.

4.7 Derived natural ingredients

Table 7 — Questions on derived natural ingredients

No.	Question	Answer
41	Why does the ISO 16128 series recommend green chemistry principles?	While not mandatory, the use of green chemistry principles (see Annex A and ISO 16128-1:2016, Annex B) is consistent with the intent of the ISO 16128 series. Ingredient manufacturers are recommended to provide cosmetic manufacturers with information related to composition, origin and processing of ingredients, including related to green chemistry, to determine ingredient indexes. For all ingredients, cosmetic manufacturers determine the category and index based on information provided.
42	Derived natural ingredients may undergo various reaction steps. Should all reaction steps be considered for obtaining natural derived ingredients?	Yes, every step of the synthetic pathway before the last chemical transformation is considered for obtaining a natural derived ingredient.
43	Is acid or alkali hydrolysis a chemical process?	Acid or alkali hydrolysis is considered as a chemical process with the intention of chemical modification. For example, when a vegetable oil, which is a natural ingredient, is hydrolyzed with an acid or alkali, the resulting ingredient is considered as a derived natural ingredient.
44	Is an ingredient obtained by hydrolyzing a natural ingredient considered as a derived natural ingredient? Is an ingredient decomposed by an enzyme considered as a natural ingredient?	Chemically-hydrolyzed ingredient is considered as a derived natural ingredient. In case of hydrolysis performed by isolated enzymes, as enzymatic reactions do not occur in nature, it is considered as a derived natural ingredient. Only in case of hydrolysis through a fermentation process existing in nature, it is considered as a natural ingredient.
45	Why is the use of halogenated non-mineral derivatives not recommended in ISO 16128?	The use of halogenated non-mineral derivatives is not recommended per ISO 16128-1 as they do not align with green chemistry principles.
46	What about solvents and catalysts which do not remain in the finished ingredient?	The use of catalysts is allowed per ISO 16128-1:2016, Annex B. If solvents are used for processing ingredients and are removed, consult ISO 16128-1:2016, Table A.2.
47	What would the classification of hydrogen peroxide be?	Since the reactants are inorganic and the product is a substance found in nature, hydrogen peroxide is derived mineral.
48	According to the definition of derived mineral ingredients, a molecule such as potassium persulfate would be considered non-natural because it does not exist in nature. The end of life for this molecule, after use or in terms of general thermodynamic stability, does result in a natural compound. Is this taken into consideration when making calculations of mineral ingredients?	Potassium persulfate is a mineral but does not exist in nature. The end of life is not taken in consideration. It is a non-natural ingredient.
49	When is chemistry an important/necessary consideration? For example, ammonium lauryl sulfate is produced in one of two ways: a) reaction with chlorosulfuric acid or b) falling film, SO_3. Both have very different chemical footprints. Also, the ammonia used for neutralizing is most certainly produced by Haber Bosch, which means the hydrogen is most likely coming from methane. Is the hydrogen source counted, or not?	What matters is the carbon source of lauryl alcohol. The hydrogen source is not considered if renewable carbon method is used.

Table 7 *(continued)*

No.	Question	Answer
50	How arethe indexes of a hydrolysate determined given the following? 15 kg of fresh organic flowers are extracted using 110 kg of water in order to obtain 100 kg of extract solution. Then a chemical hydrolysis of the extract solution is carried out using sulfuric acid. 1 % derived natural potassium sorbate is added thereafter.	Index of flower hydrolysate is calculated as follows: Starting materials: 15 kg fresh organic flowers Solvent: 110 kg water Reconstitution water: 0 kg because fresh flower is used Extraction water: 110 kg (weight of natural solvent introduced) Total weight introduced (organic ingredients and ingredient solvents): 110 + 15 So, the organic index and the natural index are 0, due to the chemically hydrolysis The organic derived index = 1 – (110 / (110+15)) = 0,12 The natural origin index = 1 as all ingredients meet the definition of derived natural ingredients. Adding 1 % derived natural potassium sorbate which has a natural origin index of 1, (1 kg into 99 kg of extract) leads to a mixture with a content: Organic origin content = 0,12*0,99 + 0*0,01=0,119 % Natural origin content = 1 as both ingredients meet the definition of derived natural ingredients.

4.8 Calculating the natural origin index

Table 8 — Questions on calculating the natural origin index

No.	Question	Answer
51	Which methods can be considered to calculate the natural origin index?	ISO 16128-1 does not impose a specific method to quantify the degree of natural origin in an ingredient, leaving it open namely to molecular weight or renewable carbon methods. 14C method is particularly useful in the sense that it allows to make sure no fossil material has been introduced into the raw material. An example of test method is ASTM D 6866[6]. Some discrepancies between 14C and molecular weight calculations can be observed. They may be related to nitrogen, oxygen or other elements content. The calculation method used is therefore be specified whenever requested.
52	What is "renewable carbon content or the related methods" under the definition of natural derived ingredients?	"Renewable carbon content or the related methods" is a method which determines a biobased content using radiocarbon analysis. For example, there are methods stipulated by ASTM D6866[6].
53	When a fatty acid, which is a derived natural ingredient, is hydrogenated, how is the hydrogenated fatty acid considered as?	Since a chemical modification was made the natural index is 0. By renewable carbon analysis the natural origin index (NOI) of final ingredient is 1. By molecular weight calculation, the NOI depends on the source of hydrogen used. Hydrogen from petroleum cracking, for example, is a non-natural reactant so NOI of the hydrogenated fatty acid is less than 1. Hydrogen from electrolysis of water is a derived natural reactant so NOI=1.

Table 8 *(continued)*

No.	Question	Answer
54	Fatty alcohol is usually manufactured by methyl esterification and hydrogenation of fatty acid, or direct hydrogenation of fatty acid. How is its natural index calculated?	Fatty acids obtained by hydrolysis of animal and vegetable triglycerides are derived natural reactants which are further chemically modified to product fatty alcohols. The natural index of a fatty alcohol obtained in this way is 0. By renewable carbon analysis the natural origin index (NOI) of the fatty alcohol is 1. By molecular weight calculation, the NOI depends on the source of hydrogen used. Hydrogen from petroleum cracking, for example, is a non-natural reactant so NOI of the fatty alcohol is less than 1. Hydrogen from electrolysis of water is a derived natural reactant so NOI=1.
55	Are fatty acid sodium salts considered as derived mineral ingredients, derived natural ingredients, or non-natural ingredients?	Fatty acid sodium salts are not considered as inorganic substances. Therefore, they are not derived mineral ingredients. Fatty acid sodium salts are considered as derived natural ingredients or non-natural ingredients depending on whether natural origin part is greater than 50 % or not. In general, sodium is considered as natural origin as it is derived from seawater.
56	When calculating the natural origin index of a substance with a wide range of chain length, e.g. surfactant, how is the molecular weight of the substance determined?	Natural origin index of ingredients with a wide range of chain length is calculated using the method indicated in ISO 16128-1:2016, Annex C or by renewable carbon method.
57	When using molecular weight, it seems simple at first glance to just cut the system into reaction input pieces, i.e. isopropyl myristate, for example, comes from isopropyl alcohol (petroleum) and myristic acid (derived natural) – 78,1 % derived natural, however, why count the oxygen (even on the petroleum) as non-natural? There are no distinguishable lines for oxygen source, it's either water or air, in general. Now that compound becomes 84,0 % derived natural.	When using a molecular weight method, the origin of starting material is considered. In the case of direct oxidation reaction by molecular oxygen, it is necessary to determine the origin of molecular oxygen as the oxygen is starting material. In case of difficulties, the renewable carbon content method, which only evaluates the % of renewable carbon, is recommended: the natural origin index of isopropyl myristate is: 82,3 %.
58	Please provide example calculations for mixed mineral-organic surfactants i.e. dicetyl phosphate?	As long as surfactants meet the ISO 16128-1 criteria, their natural origin index can be obtained by 2 ways: 1) by calculation per ISO 16128-1:2016, Annex C, or 2) by renewable carbon analysis. Dicetylphosphate is a derived natural ingredient with a NOI of 1 in either method.
59	How can the natural component of cocamidopropyl betaine be calculated? Is there a need to assess each supplier individually?	ISO 16128-1:2016, Annex C shows that by molecular weight calculation, the natural origin index (NOI) is 0,53. Renewable carbon analysis may also be used, and the results may differ slightly. The NOI is assessed from each supplier because the starting materials and reaction conditions may vary.
60	Which method is used to calculate the natural origin index among molecular weight, renewable carbon and other relevant methods?	The most suitable method should be chosen to provide an accurate and truthful result. Renewable carbon method for example is useful only for carbon-based ingredients; in the other cases, the molecular weight method is preferred.
61	How should an ingredient originating from a natural source that undergoes a hydrolytic process (e.g. deglycosidation, ester hydrolysis, etc.) with a final reduction of mass be classified?	After a hydrolytic process the ingredient obtained is derived natural. Its natural index = 0 and its natural origin index can be either calculated (ISO 16128-1:2016, Annex C) or measured by renewable carbon analysis.

Table 8 *(continued)*

No.	Question	Answer
62	What are the indexes or the contents of a raw material containing: 97,5 % ethylhexyl acetate, 1,0 % palmitoyl nonapeptide-6, 1,0 % sodium benzoate and 0,5 % lactic acid given the following case? Ethylhexyl acetate is the reaction product of acetic acid from vegetable origin (25 %) and 2-ethylhexanol from petrochemical origin (75 %). Palmitoyl nonapeptide-6 is the reaction product of palmitic acid from vegetable origin (21 %) and nonapeptide-6 from wholly petrochemical origin (79 %). Sodium benzoate is the reaction product of sodium from mineral origin (16 %) and benzoic acid of petrochemical origin (84 %). The lactic acid is from the fermentation of sucrose. None of the ingredients are organically produced.	This raw material is a mixture of four ingredients, so the indexes of each have to be calculated to determine the contents of the mixture. None of the four ingredients are organically produced, so the organic index (OI) and organic origin index (OOI) are 0. Ethylhexyl acetate is non-natural since >50 % of the ingredient is from petrochemical origin. The natural index (NI) and natural origin index (NOI) are 0. Palmitoyl nonapeptide-6 is non-natural since >50 % of the ingredient is from petrochemical origin. NI=NOI=0. Sodium benzoate is non natural since it is made from > 50 % petrochemical reactants. NI=NOI=0. Lactic acid is obtained through the natural fermentation of sugars. NI=NOI=1. See Table 9.
63	What are the indexes or the contents of the mixture from the previous question if, instead of ethylhexyl acetate, ethylhexyl palmitate obtained from esterification of palmitic acid of vegetable origin (65 %) and 2-ethylhexanol of petrochemical origin (35 %) is used?	This cosmetic raw material is a mixture of four ingredients. None of the ingredients are organically produced. OI=OOI= 0 — Ethylhexyl palmitate is obtained through esterification between palmitic acid from vegetable origin (65 % of the molecule) and 2-ethylhexanol from petrochemical origin (35 % of the molecule). NI=0; NOI= 0,65 = (65/(65 + 35)). — Palmitoyl nonapeptide-6 is non-natural since >50 % of the ingredient is from petrochemical origin. NI=NOI=0. — Sodium benzoate is non natural since it is made from > 50 % petrochemical reactants. NI = 0; NOI = 0 — Lactic acid is obtained through the natural fermentation of sugars. NI = 1; NOI = 1 See Table 10.

Table 9 — Example of a mixture 1

COMPOSITION	%	NI	NC (%)	NOI	NOC (%)
Ethylhexyl acetate	97,5 %	0	—	0	—
Palmitoyl nonapeptide-6	1 %	0	—	0	—
Sodium benzoate	1 %	0	—	0	—
Lactic acid	0,5 %	1	—	1	—
Cosmetic raw material	100 %	—	0,5 %	—	0,5 %

The raw material is a mixture of four ingredients. Natural and natural origin indexes for each ingredient are displayed in Table 9.

The raw material features a natural content of 0,5 % and a natural origin content of 0,5 %.

Table 10 — Example of a mixture 2

COMPOSITION	%	NI	NC (%)	NOI	NOC (%)
Ethylhexyl palmitate	97,5 %	0	—	0,65	—
Palmitoyl nonapeptide-6	1 %	0	—	0	—
Sodium benzoate	1 %	0	—	0	—
Lactic acid	0,5 %	1	—	1	—
Cosmetic raw material	100 %	—	0,5 %	—	63,8 %

The raw material is a mixture of 4 ingredients. Natural and natural origin indexes for each ingredient are displayed in Table 10.

The raw material features a natural content of 0,5 % and a natural origin content of 63,8 %.

4.9 Examples

Table 11 — Additional examples for derived natural ingredients

No.	Question	Answer
64	Can the following ingredients be considered of wholly derived natural origin: 1-3 propanediol, glycerin, Hyaluronic acid?	1,3-propanediol obtained through fermentation has a natural origin index of 1(as glucose is derived natural). Glycerin obtained from a plant-based oil has a natural origin index of 1. Hyaluronic acid can be either a natural or derived natural ingredient, depending on the production method used.
65	Is butylene glycol a derived natural ingredient if butylene glycol is obtained through the natural fermentation of sugars (butylene glycol comes from the chemical modification of the acetaldehyde which is obtained through alcoholic fermentation of sugar cane molasses)?	As there is a chemical modification after the fermentation, the butylene glycol is not a natural ingredient NI= 0 and it is a derived natural ingredient NOI =1.
66	How is citric acid defined according to ISO 16128?	It depends on the feedstock and processing of the ingredient. Assuming the citrate salt is obtained through the natural fermentation of sugars and acidified using sulfuric acid, citric acid is derived naturally.
67	What are the indexes of a native guar gum and those of its chemically modified derivatives (Hydrolyzed guar gum and depolymerised guar gum)?	The native guar gum is chemically hydrolyzed or chemically depolymerised. These correspond to chemical modifications of molecules existing in nature. Hydrolyzed guar gum and depolymerized guar gum are derived natural ingredients. They both feature a Natural Index of 0 and a Natural Origin Index of 1.

4.10 Other chemical and biological processes

Table 12 — Questions on other chemical and biological processes

No.	Question	Answer
68	Can all kinds of esterification processes be considered?	The final ingredient is classified according to the definitions in ISO 16128-1. As esterification can use various process conditions, the documents recommend the conditions most consistent with the green chemistry principles where possible and practicable (e.g. enzymatic esterification in water vs. reaction in a petrochemical process solvent system). For details, see Table 1, row 0.
69	Can a-non natural ferment substrate be used to obtain a derived natural ingredient?	No, when the fermentation substrate is non-natural, the ingredient obtained is then non- natural (which is consistent with ISO 16128-1:2016 Table A.1).
70	Are the following processes consistent with the green chemistry principles: nitration, nitrosation, nitrification, halogenation, silylation, sulfonation, processes using isocyanate, processes using short alkyl chloride or short alkyl sulphate derivatives (less than C-5), processes using phosphorous oxychloride or glycidyl ammonium chloride, treatments using mercury, processes known as releasing nitrosamines, ionizing irradiation?	This has to be answered on a case-by-case basis. Manufacturers can find guidance for determining whether the process they use is consistent or not with green chemistry principles in Annex A.

4.11 Index and content

Table 13 — Questions on index and content

No.	Question	Answer
71	Do ingredients always have only indexes or contents?	No, it depends if they are single ingredients or mixtures. Single ingredients, whether natural, derived natural after the last chemical transformation or extracts which are not modified post filtration, are characterized by their various indexes, as defined in ISO 16128-2:2017, Clause 4. When single ingredients are mixed with solvents, additives, preservatives or other ingredients, they are a mixture and are not characterized by their index but by their content. As for finished cosmetic product, “contents” are calculated according the method described in ISO 16128-2:2017, Clause 5.
72	In case of a single ingredient, when natural origin part in its chemical structure is less than 50 %, natural origin part is discarded, and the natural origin index of such ingredient is 0. On the other hand, in case of premixed ingredients (a mixture of ingredients), even though the total of natural origin part from each ingredient is less than 0.5, there is no need to discard natural origin part. Therefore, for example, is the natural origin index of 0,3 possible?	Derived natural ingredients are cosmetic ingredients of greater than 50 % natural origin by molecular weight, by renewable carbon content, or by any other relevant methods. Therefore, the indexes for single ingredient and the contents for premixed ingredients can be calculated as shown in Table 14.