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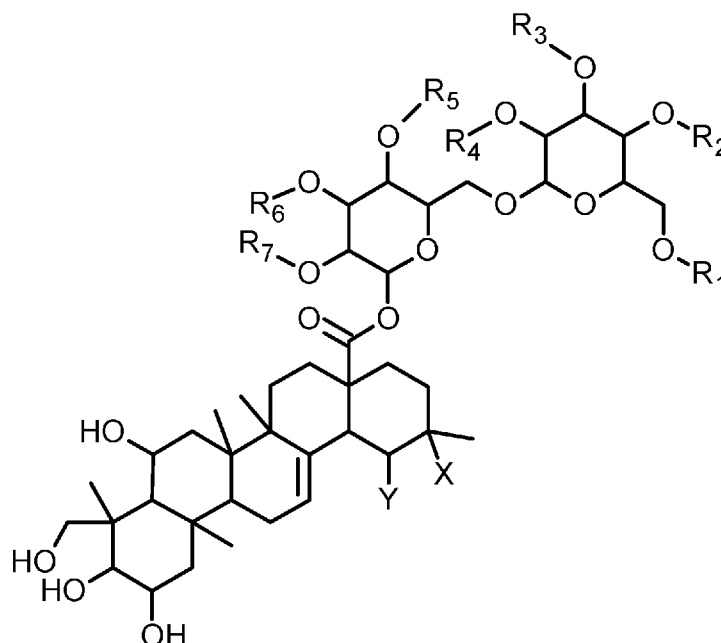
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(54) Title: TASTE BALANCING BOTANICAL COMPOUNDS



(57) Abstract: The invention relates to novel compounds according to formula (I), a method for producing such a compound, a mixture comprising such a compound, a composition for food or pleasure or a pharmaceutical composition comprising one or more such compound(s) or a such a mixture, as well as to the use of such a compound or of such a mixture for imparting or modifying a sweet taste impression and to a method for imparting or modifying a sweet taste impression.



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Taste balancing botanical compounds

The invention relates to novel compounds according to formula (I), a method for producing such a compound, a mixture comprising such a compound, a composition for food or pleasure or a pharmaceutical composition comprising one or more such compound(s) or a such a mixture, as well as to the use of such a compound or of such a mixture for imparting
5 or modifying a sweet taste impression and to a method for imparting or modifying a sweet taste impression.

Consumers generally have a strong preference for foodstuffs or indulgence foods, which have a large amount of high caloric sugar, in particular sucrose (saccharose), glucose, fructose or mixtures thereof, due to the pleasant sweetness and sweetness profile
10 associated therewith.

However, it is generally known that a large content of readily metabolizable carbohydrates causes a steep rise in blood sugar levels, leads to the formation of fat deposits and ultimately can result in health problems such as overweight, obesity, insulin resistance, age-onset diabetes and complications thereof.

15 Furthermore, several of such carbohydrates may negatively affect dental health, as they can be metabolized by several bacteria, which are present in the oral cavity. The metabolites of these carbohydrates may in turn degrade the tooth enamel and finally lead to caries.

The World Health Organization (WHO) recommends a daily uptake of free sugars of at
20 most 10 % of the daily total energy supply. Considering a daily total energy supply of 2000

kcal, the recommendation corresponds to approximately 50 g of free sugar such as glucose, fructose or saccharose (WHO, 2015, ISBN 9789241549028).

The actual daily uptake of free sugars of men and women in industrialized countries, e.g. in Germany, lies significantly higher than the recommendation of the WHO, i.e. 61 g/day
5 (women) or, respectively, 78 g/day (men).

Therefore, it has long been an objective to reduce the high caloric sugar content of food or beverage products as far as possible, without significantly affecting the perceived sweetness.

One measure is to replace the carbohydrates by sweeteners. Sweeteners are chemical
10 compounds, which have no or only a small caloric value and, at the same time, provide a strong sweet taste impression. An overview of such sweeteners may, for example, be found in the Journal of the American Dietetic Association 2004, 104 (2), 255-275).

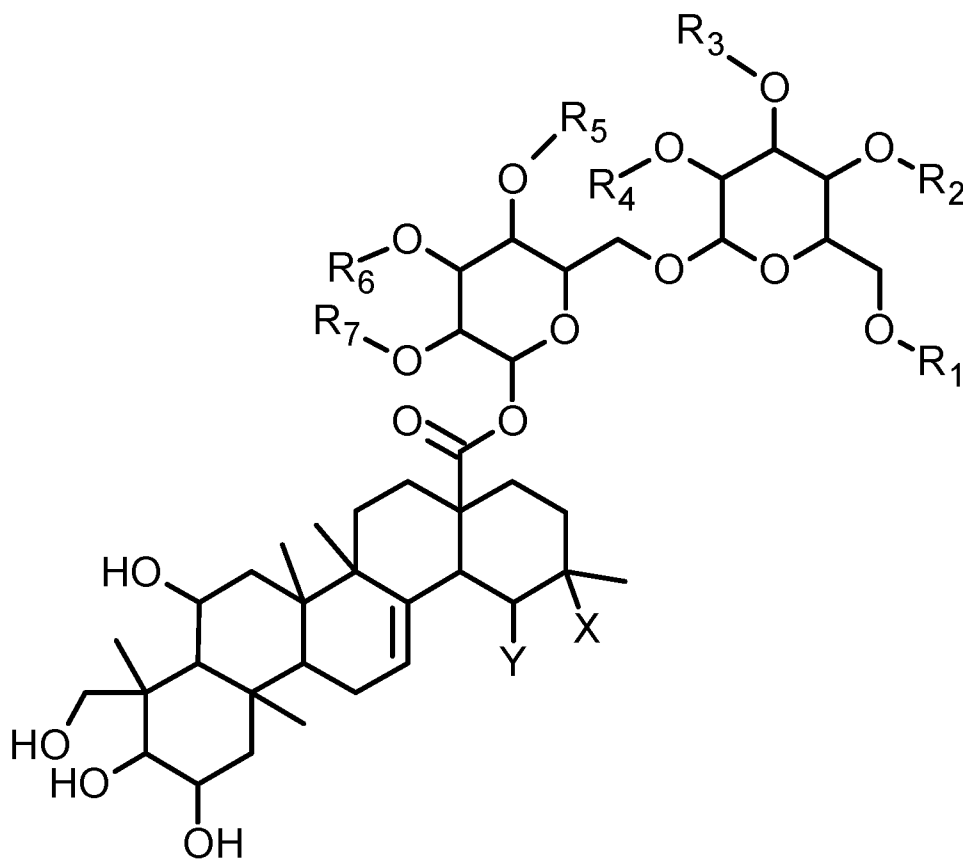
With their high sweetening power, these sweeteners may be added to foodstuff in low amounts. In this way, it is possible to replace large amounts of carbohydrates with low
15 amounts of sweeteners.

Such sweeteners include steviosides from *Stevia rebaudiana*, rubusosides from *Rubus suavisissimus* and mogrosides from *Siraitia grosvenorii*.

However, one drawback of these sweeteners is their unpleasant aftertaste, including taste impressions such as lingering or bitter. The application of these sweeteners is thus limited.

20 It was thus an object of the present invention to provide novel substances with sweetness-modulating attributes, which may improve the taste profile of sugar-reduced foodstuff or beverage.

The primary object of the present invention is solved by a compound according to formula (I):



wherein X and Y are selected from hydrogen or CH₃, wherein only one of X and Y is CH₃,

wherein R¹ to R⁷ are selected from hydrogen or a saccharide, wherein the or all monomer subunit(s) of the saccharide is / are monomer(s) selected from the group consisting of glucose, galactose, fructose, rhamnose, xylose, glucuronic acid, quinovose, arabinose and mixtures thereof,

wherein R¹ to R⁷ are selected such that the compound comprises a sum of at least two monomer subunits represented by one or more of R¹ to R⁷,

or a salt thereof.

10 In case a residue of R¹ to R⁷ is a saccharide, this saccharide can be bound to the remaining formula (I) via an α- or via a β-glycosidic bond, which may be individual for each saccharide.

Preferably, the saccharide is bound to the remaining formula (I) via an α -1-2-, α -1-3-, α -1-4-, α -1-6-, β -1-2-, β -1-3-, β -1-4- or β -1-6-glycosidic bond, which may be individual for each saccharide.

5 The term "saccharide" as used herein describes a substituent structure. Preferably, this substituent is obtained by removing the hemiacetal hydroxyl group from the monosaccharide or from the first monosaccharide subunit of the polymeric chain of monosaccharide subunits to form a glycosidic bond.

Further, the term "saccharide" as used herein describes mono-, di-, tri-, oligo- and/or polysaccharides.

10 The terms "di-, tri-, oligo- and polysaccharides", as used herein describes a polymeric chain of monosaccharide subunits, which are bound together by glycosidic bonds. The polymeric chain may be linear or branched at one or more elements of the chain, wherein "linear" describes that each monomer of the polymeric chain is connected to two other monomers, wherein the first and the last monomer of the chain are only connected to one other
15 monomer. Preferably, the polymeric chain is linear. The monosaccharide subunits of the polymeric chain of monosaccharide subunits may be the same monosaccharide subunits or may be different units, which is described by the term "mixtures thereof" as used in the selection of monomers.

The term "monosaccharide subunit", as used herein describes a monosaccharide, which
20 is, in the di-, tri-, oligo- or polysaccharides, connected to at least one other monosaccharide to form the di-, tri-, oligo- or polysaccharides. The term describes a structure, which is based on the single monosaccharide molecule but which is connected to at least one further monosaccharide monomer to form the di-, tri-, oligo- or polysaccharides.

The term "wherein R^1 to R^7 are selected such that the compound comprises a sum of at
25 least two monomer subunits represented by one or more of R^1 to R^7 " as used herein describes that even though R^1 to R^7 may be selected individually, formula (I) requires that in sum at least two monomer subunits need to be found among the residues R^1 to R^7 . The at least two monomer subunits can be present in the same residue of R^1 to R^7 or in different residues of R^1 to R^7 . Thus, e.g. R^1 may comprise one monomer subunit and e.g. R^2 may
30 comprise another monomer subunit. Additionally or alternatively, e.g. R^1 may comprise two (or more) subunits.

The salt of a compound according to formula (I), as described herein, may be any salt. Preferably, the salt is a pharmaceutically acceptable salt.

The compounds according to formula (I) are distinct glucosides of madecassic acid (CAS registry number: 18449-41-7; with X=H and Y=CH₃) or of terminolic acid (CAS registry
5 number: 564-13-6; with X=CH₃ and Y=H).

Madecassoside and terminolside are known glucosides of madecassic acid or terminolic acid.

Madecassoside (CAS registry number: 34540-22-2) has been known since the middle of the 20th century. The sugar residue of madecassoside was described by Pinhas et al in
10 1967 as 2x D-glucose and 1x L-rhamnose (Pinhas et al., Bulletin de la Societe Chimique de France (1967), (6), 1888-90). However, no application regarding sweetness-modulation has been described for these glucosides. Instead, madecassic acid and terminolic acid or, respectively, madecassoside and terminolside are rather used for cosmetic purposes.

Little is known about further glucosides of madecassic acid or terminolic acid. Only
15 madecassic acid-28-monoglucoside (Centelloside C, CAS registry number 1361016-45-6) and madecassic acid-28-diglucoside (Centellasaponin B, CAS registry number 386223-75-2) are known.

Madecassic acid and terminolic acid are the main components synthesized by the plant
20 *Gotu Kola* (*Centella asiatica*), in addition to the triterpenes asiaticoside and asiatic acid (Feng-Lun et al., Biomedical Chromatography (2008), 22(2), 119-124).

Several methods for obtaining an extract from *Gotu Kola*, which contains high amounts of madecassoside have been described. **EP 0867447 A1** describes the production of a water-soluble extract from *Gotu Kola*, which contains high amounts of asiaticoside and madecassoside. Furthermore, **FR 2848117 A1** describes the production of an extract
25 containing more than 95% of a mixture of madecassoside and terminolside.

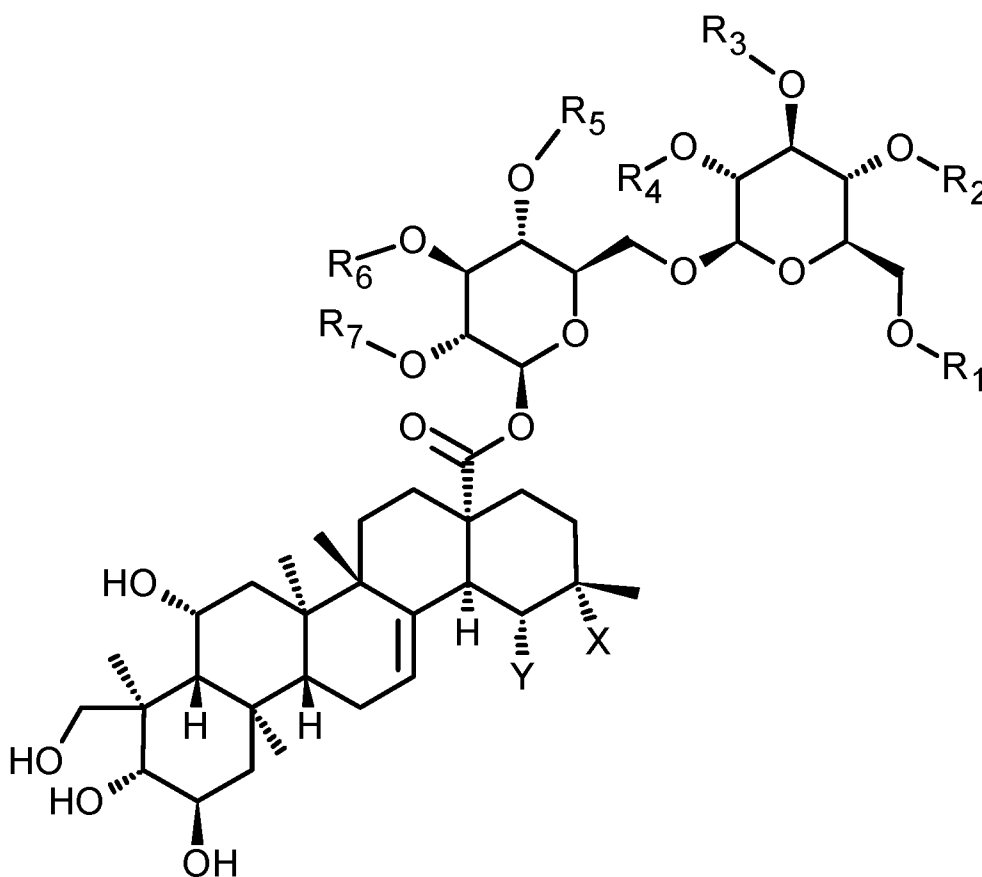
Extracts from *Gotu Kola* are also mainly used for cosmetic purposes such as in skin care products for preventing skin aging (**WO 97/39734 A1**) or for preventing hair loss (**WO 2005/123032 A2**). However, no application regarding sweetness-modulation has been described.

It was thus surprisingly found that the compounds according to formula (I) provide sweetness-modulating attributes, which may improve the taste profile of sugar-reduced foodstuff or beverage. This was particularly surprising, since madecassic acid and terminolic acid provide a bitter taste.

- 5 Moreover, this was also surprising, since it was found that e.g. madecassoside does not provide any sweetness-modulating attributes, as shown in example 5.1 below.

The compounds according to the invention may be of any possible three-dimensional structure, i.e. formula (I) encompasses any possible stereoisomer.

Preferably, the compounds according to the invention are of formula (Ia):



10

wherein X and Y are selected from hydrogen or CH₃, wherein only one of X and Y is CH₃,

wherein R¹ to R⁷ are selected from hydrogen or a saccharide, wherein the or all monomer subunit(s) of the saccharide is / are monomer(s) selected from the group consisting of

glucose, galactose, fructose, rhamnose, xylose, glucuronic acid, quinovose, arabinose and mixtures thereof,

wherein R^1 to R^7 are selected such that the compound comprises a sum of at least two monomer subunits represented by one or more of R^1 to R^7 ,

5 or a salt thereof.

Further preferably for a compound according to the invention, the compound is selected from compounds 1a to 70b according to the following table 1, with Rha = Rhamnose and Glc = Glucose:

No.	R^1	R^2	R^3	R^4	R^5	R^6	R^7	X	Y
1a	H	α -1->4 Rha; α -1->4 Glc	H	H	H	H	H	H	CH ₃
2a	H	α -1->4 Rha	H	H	α -1->4 Glc	H	H	H	CH ₃
3a	H	α -1->4 Rha	H	H	H	α -1->3 Glc	H	H	CH ₃
4a	H	α -1->4 Rha; α -1->3 Glc	H	H	H	H	H	H	CH ₃
5a	H	α -1->4 Rha	α -1->3 Glc	H	H	H	H	H	CH ₃
6a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	H	CH ₃
7a	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc	H	H	H	CH ₃
8a	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
9a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	H	CH ₃
10a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	H	CH ₃
11a	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
12a	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃

13a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	H	CH ₃
14a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	H	CH ₃
15a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
16a	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
17a	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
18a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	H	CH ₃
19a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	H	CH ₃
20a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
21a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
22a	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
23a	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
24a	H	α -1->4 Rha;	H	H	H	H	H	H	CH ₃

		α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc							
25a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	H	CH ₃
26a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
27a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
28a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
29a	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
30a	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
31a	α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	H	CH ₃
32a	H	α -1->4 Rha	H	H	α -1->4 Glc	H	H	H	CH ₃
33a	H	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	H	CH ₃
34a	α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	H	CH ₃
35a	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	H	CH ₃
36a	α -1->6 Glc, α -1->4 Glc	H	H	H	H	H	H	H	CH ₃
37a	α -1->6 Glc	α -1->4 Rha	H	H	α -1->4 Glc	H	H	H	CH ₃
38a	H	α -1->4 Rha,	H	H	H	H	H	H	CH ₃

		α -1->4 Glc, α -1->6 Glc							
39a	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc	H	H	H	H	H	H	CH ₃
40a	H	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc, α -1->4 Glc	H	H	H	CH ₃
41a	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->6 Glc	H	H	H	CH ₃
42a	α -1->6 Glc, α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	H	CH ₃
43a	α -1->6 Glc, α -1->4 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	H	CH ₃
44a	α -1->6 Glc, α -1->6 Glc, α -1->4 Glc	α -1->4 Rha	H	H	H	H	H	H	CH ₃
45a	α -1->6 Glc, α -1->6 Glc	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	H	CH ₃
46a	α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	α -1->4 Glc	H	H	H	CH ₃
47a	α -1->6 Glc, α -1->4 Glc	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	H	CH ₃
48a	α -1->6 Glc, α -1->4 Glc	α -1->4 Rha	H	H	α -1->4 Glc,	H	H	H	CH ₃
49a	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc	H	H	H	H	H	H	CH ₃
50a	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc	H	H	H	H	H	H	CH ₃
51a	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc,	H	H	H	CH ₃
52a	α -1->6 Glc	α -1->4 Rha,	H	H	α -1->4 Glc, α -1->4 Glc	H	H	H	CH ₃
53a	α -1->6 Glc	α -1->4 Rha,	H	H	α -1->4 Glc, α -1->6 Glc	H	H	H	CH ₃
54a	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc, α -1->4 Glc	H	H	H	H	H	H	CH ₃
55a	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc, α -1->6 Glc	H	H	H	H	H	H	CH ₃

56a	H	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc, α -1->4 Glc	H	H	H	H	H	H	CH ₃
57a	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc	H	H	α -1->4 Glc,	H	H	H	CH ₃
58a	H	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc	H	H	α -1->4 Glc,	H	H	H	CH ₃
59a	H	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc, α -1->4 Glc	H	H	H	CH ₃
60a	H	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc, α -1->6 Glc	H	H	H	CH ₃
61a	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->4 Glc, α -1->4 Glc	H	H	H	CH ₃
62a	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->6 Glc, α -1->4 Glc	H	H	H	CH ₃
63a	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->4 Glc, α -1->6 Glc	H	H	H	CH ₃
64a	α -1->6 Glc, α -1->6 Glc, α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	H	CH ₃
65a	H	α -1->4 Rha	H	β -1->2 Glc	H	H	H	H	CH ₃
66a	H	α -1->4 Rha	H	H	H	H	β -1->2 Glc	H	CH ₃
67a	H	α -1->4 Rha, β -1->2 Glc	H	H	H	H	H	H	CH ₃
68a	H	α -1->4 Rha	β -1->3 Glc	H	H	H	H	H	CH ₃
69a	H	α -1->4 Rha	H	H	H	β -1->3 Glc	H	H	CH ₃
70a	H	α -1->4 Rha, β -1->3 Glc	H	H	H	H	H	H	CH ₃
1b	H	α -1->4 Rha; α -1->4 Glc	H	H	H	H	H	CH ₃	H
2b	H	α -1->4 Rha	H	H	α -1->4 Glc	H	H	CH ₃	H
3b	H	α -1->4 Rha	H	H	H	α -1->3 Glc	H	CH ₃	H

4b	H	α -1->4 Rha; α -1->3 Glc	H	H	H	H	H	CH3	H
5b	H	α -1->4 Rha	α -1->3 Glc	H	H	H	H	CH3	H
6b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	CH3	H
7b	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc	H	H	CH3	H
8b	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
9b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	CH3	H
10b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	CH3	H
11b	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
12b	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
13b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	CH3	H
14b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	CH3	H
15b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
16b	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
17b	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
18b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc;	H	H	H	H	H	CH3	H

		α -1->4 Glc; α -1->4 Glc; α -1->4 Glc							
19b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	CH3	H
20b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
21b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
22b	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
23b	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
24b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	CH3	H
25b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	CH3	H
26b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
27b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
28b	H	α -1->4 Rha;	H	H	α -1->4 Glc; α -1->4 Glc;	H	H	CH3	H

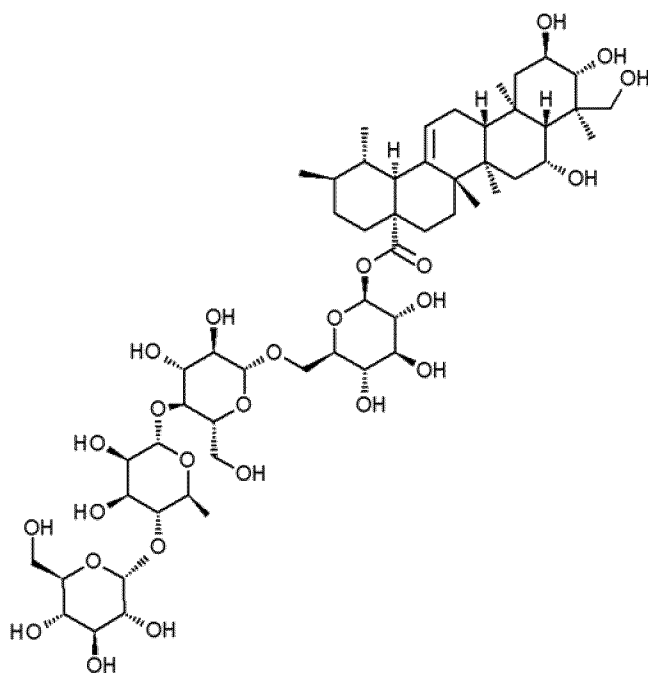
		α -1->4 Glc; α -1->4 Glc			α -1->4 Glc; α -1->4 Glc				
29b	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
30b	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
31b	α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	CH3	H
32b	H	α -1->4 Rha	H	H	α -1->4 Glc	H	H	CH3	H
33b	H	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	CH3	H
34b	α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	CH3	H
35b	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	CH3	H
36b	α -1->6 Glc, α -1->4 Glc	H	H	H	H	H	H	CH3	H
37b	α -1->6 Glc	α -1->4 Rha	H	H	α -1->4 Glc	H	H	CH3	H
38b	H	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc	H	H	H	H	H	CH3	H
39b	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc	H	H	H	H	H	CH3	H
40b	H	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc, α -1->4 Glc	H	H	CH3	H
41b	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->6 Glc	H	H	CH3	H
42b	α -1->6 Glc, α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	CH3	H
43b	α -1->6 Glc, α -1->4 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	CH3	H
44b	α -1->6 Glc, α -1->6 Glc, α -1->4 Glc	α -1->4 Rha	H	H	H	H	H	CH3	H
45b	α -1->6 Glc, α -1->6 Glc	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	CH3	H
46b	α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	α -1->4 Glc	H	H	CH3	H

47b	α -1->6 Glc, α -1->4 Glc	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	CH3	H
48b	α -1->6 Glc, α -1->4 Glc	α -1->4 Rha	H	H	α -1->4 Glc,	H	H	CH3	H
49b	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc	H	H	H	H	H	CH3	H
50b	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc	H	H	H	H	H	CH3	H
51b	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc,	H	H	CH3	H
52b	α -1->6 Glc	α -1->4 Rha,	H	H	α -1->4 Glc, α -1->4 Glc	H	H	CH3	H
53b	α -1->6 Glc	α -1->4 Rha,	H	H	α -1->4 Glc, α -1->6 Glc	H	H	CH3	H
54b	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc, α -1->4 Glc	H	H	H	H	H	CH3	H
55b	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc, α -1->6 Glc	H	H	H	H	H	CH3	H
56b	H	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc, α -1->4 Glc	H	H	H	H	H	CH3	H
57b	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc	H	H	α -1->4 Glc,	H	H	CH3	H
58b	H	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc	H	H	α -1->4 Glc,	H	H	CH3	H
59b	H	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc, α -1->4 Glc	H	H	CH3	H
60b	H	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc, α -1->6 Glc	H	H	CH3	H
61b	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->4 Glc, α -1->4 Glc	H	H	CH3	H
62b	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->6 Glc, α -1->4 Glc	H	H	CH3	H

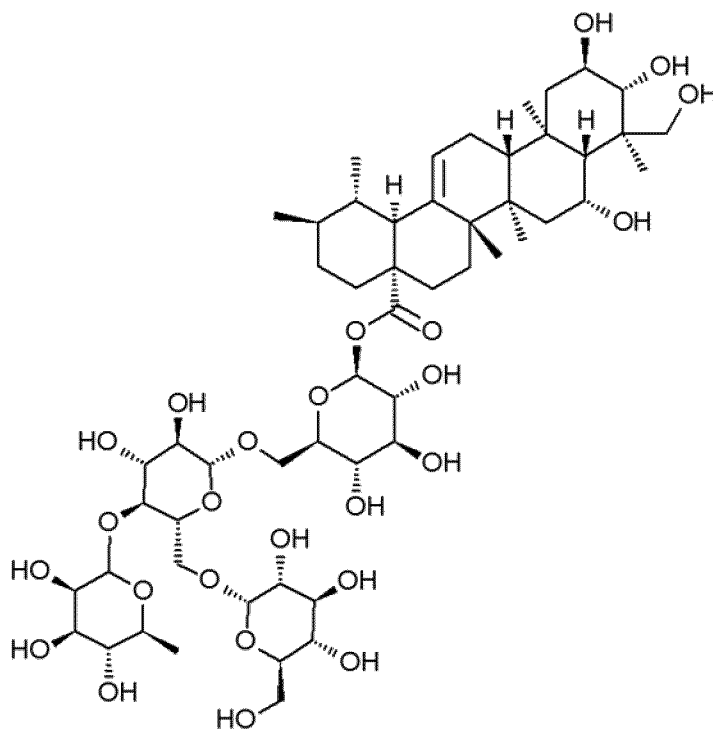
63b	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->4 Glc, α -1->6 Glc	H	H	CH3	H
64b	α -1->6 Glc, α -1->6 Glc, α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	CH3	H
65b	H	α -1->4 Rha	H	β -1->2 Glc	H	H	H	CH3	H
66b	H	α -1->4 Rha	H	H	H	H	β -1->2 Glc	CH3	H
67b	H	α -1->4 Rha, β -1->2 Glc	H	H	H	H	H	CH3	H
68b	H	α -1->4 Rha	β -1->3 Glc	H	H	H	H	CH3	H
69b	H	α -1->4 Rha	H	H	H	β -1->3 Glc	H	CH3	H
70b	H	α -1->4 Rha, β -1->3 Glc	H	H	H	H	H	CH3	H

The term " α -1->4 Rha", and corresponding terms, in the above table 1 describes that the respective residue is rhamnose, or glucose if "Glc" is mentioned, which is bound to the remaining structure via an α -1,4 glycosidic bond. The same applies accordingly to the corresponding terms in the above table 1. Thus, the term "rhamnose" or "glucose", as used in this context, does not describe a non-connected, single rhamnose or glucose molecule. Instead, the term describes a structure, which is based on the single rhamnose or glucose molecule but which is connected to the remaining structure to form the compound according to the invention.

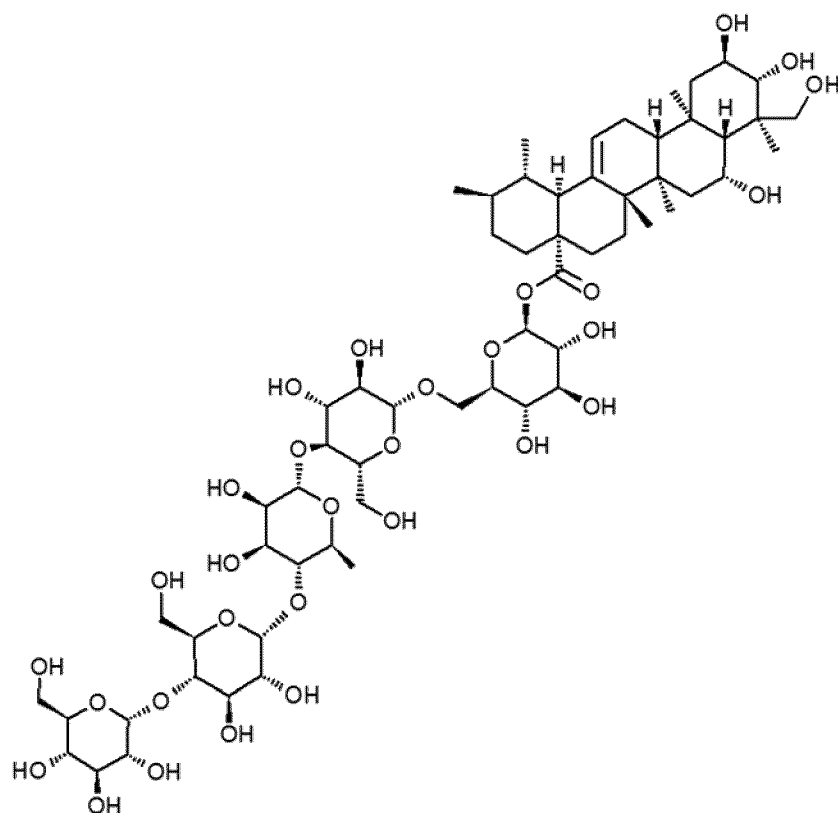
It is also preferred that the compound according to the invention is selected from



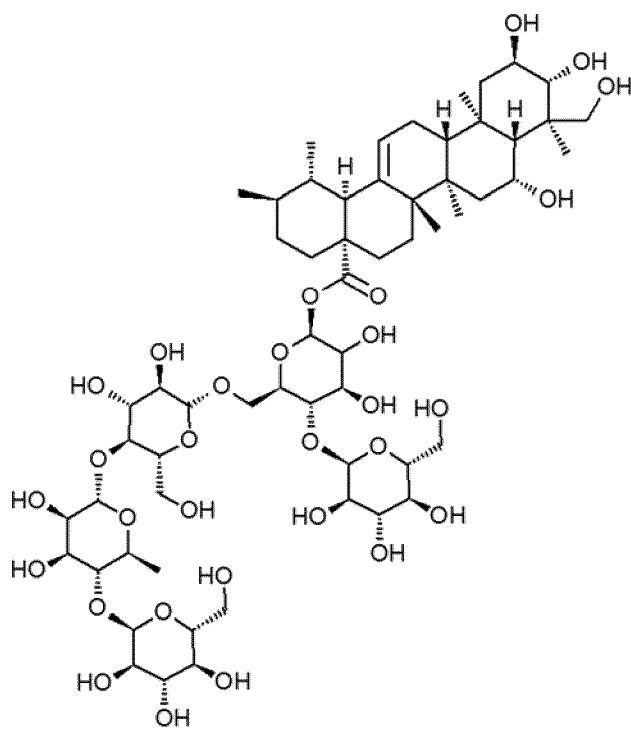
Compound 1a



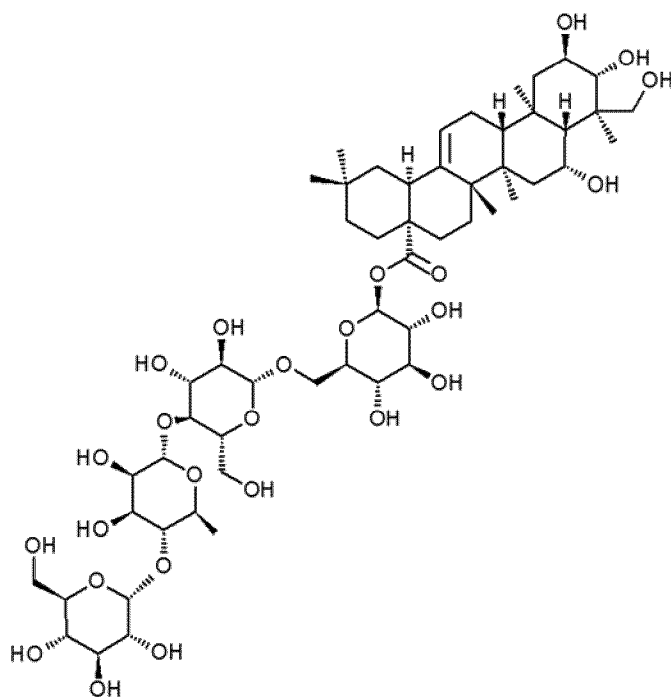
Compound 31a



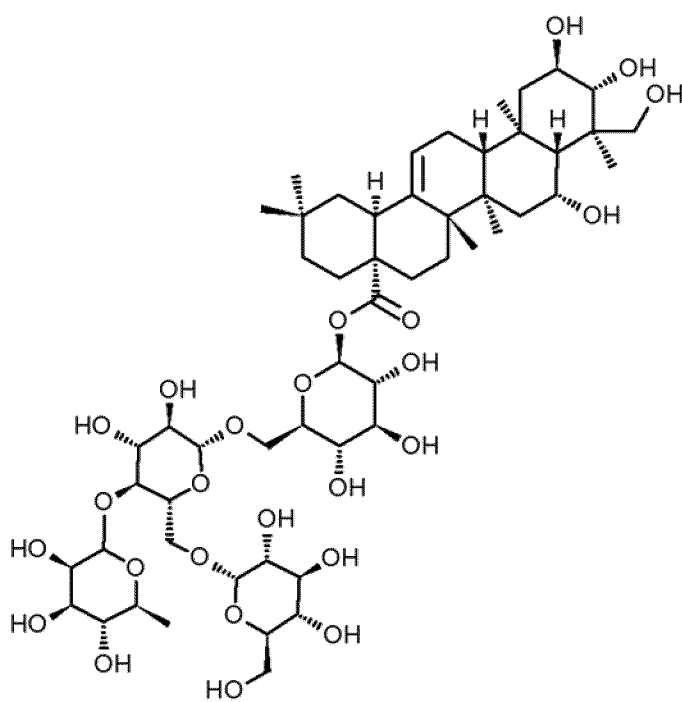
Compound 6a



Compound 7a



Compound 1b



Compound 31b

CC12CCC3C(C1CC4=C(C=C3)C(=C(C=C4)O)C)C(=O)O[C@@H]5C[C@H](O)[C@@H](CO)[C@H](O)[C@H]5O

5 or any stereoisomer or salt thereof.

The invention further relates to a method for producing a compound according to the invention or a salt thereof, comprising the following steps:

- (i) providing madecassoside and/or terminoloside, preferably providing a plant extract comprising madecassoside and/or terminoloside, particularly preferably providing a plant extract of *Gotu Kola* comprising madecassoside and/or terminoloside, further preferably providing a plant extract of *Gotu Kola* comprising 50 to 95 wt.-% madecassoside and/or terminoloside, based on the total weight of the plant extract,
- (ii) providing one or more saccharide(s), preferably wherein the, one or more or all saccharide(s) is / are selected from the group consisting of glucose, galactose, fructose, rhamnose, xylose, saccharose, lactose, UDP-glucose, maltose, starch, maltodextrin, cyclodextrin, glucuronic acid, quinovose, arabinose and mixtures thereof,
- (iii) providing a glycosyltransferase
- (iv) mixing the provided components and incubating the mixed components to obtain a mixture comprising a compound according to the invention.

It is known that *Gotu Kola* mainly synthesizes the triterpenes asiaticoside, madecassoside, asiatic acid, madecassic acid, terminolic acid and terminoloside. These triterpenes contribute (in sum) to more than 1 % of the dried plant mass (Feng-Lun et al., Biomedical Chromatography 2008, 22(2), 119-124). Therefore, it is preferred that extracts from *Gotu Kola* are used as starting material for providing madecassoside and/or terminoloside.

Preferably, such an extract comprises 1 to 100 wt.-% of asiaticoside, madecassoside, asiatic acid, madecassic acid, terminolic acid and terminoloside, particularly preferably such an extract comprises 50 to 95 wt.-% madecassoside and/or terminoloside, based on the total weight of the plant extract.

Furthermore, it is preferred that the glycosyltransferase provided in step (iii) is a glycosyltransferase according to Gerwig et al., Advances in Carbohydrate Chemistry and Biochemistry, 2016, 73, or according to Zhao et al., J Agric. Food Chem., 2020, 68 or a mixture thereof.

Thus, it is preferred that the glycosyltransferase provided in step (iii) is selected from the group consisting of glucanotransferases, glucosyltransferases and mixtures thereof,

- preferably wherein the glycosyltransferase is selected from the group consisting of α -glucosyltransferases (such as α -glucosidase, CGTase, glucan sucrase (preferably glucansucrase GTF 180) or dextranase), β -glucosyltransferases (such as 1,2- β -glucosyltransferase (OleD, preferably from *Streptomyces antibioticus*, Yjic, preferably from *Bacillus licheniformis*, or UGTSL2, preferably from *Solanum lycopersicum*), β -1,3-glucosyltransferases (such as laminarinase) or β -1,4-glucosyltransferase), β -fructosidases (such as enzyme preparations originating from *A. niger*, *Aspergillus sp.*, *A. aculeatus* or *B. subtilis*), α -galactosidases (such as enzyme preparations originating from *A. oryzae*, *Kluyveromyces lactis*, *Kluyveromyces sp.*, *B. licheniformis*), β -galactosidases (such as enzyme preparations originating from *Kluyveromces lactis* or *B. circulans*), L-rhamnosidases (such as enzyme preparations originating from *Thermomicrobia sp.* or *Penicillium decumbens*) and mixtures thereof,
- particularly preferably wherein the glycosyltransferase is selected from the group consisting of cyclomaltodextrin glucanotransferase, glucan sucrose, yjic glucosyltransferase, oleandomycin glycosyltransferase and mixtures thereof.

- Preferably, the glycosyltransferase is obtained commercially or via a cell culture approach, in which cells, preferably E.coli cells, are transformed with a vector comprising the coding sequence of the glycosyltransferase of interest, e.g. as described in the below example section.

- By enzymatic glycosylation, monosaccharides from substrates as e.g. saccharose, lactose, UDP-glucose, maltose, starch, maltodextrin, cyclodextrin and mixtures thereof can be bound to formula (I), i.e. as one or more of R¹ to R⁷, via a α -1-2-, α -1-3-, α -1-4-, α -1-6-, β -1-2-, β -1-3-, β -1-4- or β -1-6-glycosidic bond, which may be individual for each saccharide.

Further preferably, the, one or more or all saccharide(s) provided in step (ii) is / are selected from the group consisting of maltodextrin, saccharose and mixtures thereof, and/or the glycosyltransferase is selected from the group consisting of CTGase, Glucansucrase GTF 180 and mixtures thereof.

Particularly preferably, the saccharide provided in step (ii) comprises or consists of maltodextrin and saccharose and the glycosyltransferase provided in step (iii) comprises or consists of CTGase and Glucansucrase GTF 180.

5 Even further preferably, the saccharide provided in step (ii) consists of maltodextrin and saccharose and the glycosyltransferase provided in step (iii) consists of CTGase and Glucansucrase GTF 180.

It is preferred that in the method according to the invention the mixing and/or incubation in step (iv) is performed while shaking.

10 The incubation in step (iv) allows a glycosylation of the provided madecassoside and/or terminoloside to obtain a compound according to formula (I).

Preferably, the method additionally comprises the step of purifying the obtained glycosylated madecassoside and/or terminoloside, wherein the term "purifying" is broadly understood as increasing the concentration of the obtained glycosylated madecassoside and/or terminoloside, e.g. by removing other components of the obtained mixture.

15 It is preferred that the incubation in step (iv) is performed at a temperature in a range of from 30 to 60 °C, preferably in a range of from 35 to 55 °C, since particularly advantageous yields were obtained in these temperature ranges.

Additionally or alternatively, the incubation in step (iv) is performed for 5 to 48 h, preferably for 12 to 36 h, particularly preferably for 18 to 30 h, further preferably for 20 to 27 h.

20 Furthermore, it is preferred that the incubation in step (iv) is inactivated, preferably before the step of purification is performed, if present.

Additionally or alternatively, the method according to the invention further comprises the step of purifying the mixture obtained after step (iv), preferably by chromatography, such as ion exchange chromatography, or by solid phase purification or microfiltration.

25 Therefore, it is additionally or alternatively to the above temperature ranges preferred that the incubation in step (iv) is inactivated, preferably by applying a temperature in the range of from 70 to 100 °C, preferably in the range of from 75 to 90 °C, particularly preferably in the range of from 75 to 85 °C, and/or

that the mixture obtained in step (iv) is dried, preferably by a drying method selected from the group consisting of freeze-drying, spray drying, vacuum belt drying or heat drying, particularly preferably by freeze-drying.

5 The invention further relates to a compound according to the invention, wherein the compound is obtainable or obtained by a method according to the invention, or a salt thereof.

Furthermore, the invention relates to a mixture comprising

- (i) one or more compounds according to the invention, or
- (ii) one or more salts according to the invention, or
- 10 (iii) one or more compounds according to the invention and one or more salts according to the invention,

preferably wherein the mixture is obtained or obtainable by a method according to the invention.

15 Preferably in the mixture according to the invention, the total weight of the compound(s) according to the invention and their salts is in a range of from 0.1 to 99 wt.-%, preferably in a range of from 1 to 50 wt.-%, particularly preferably in a range of from 3 to 10 wt.-%, based on the total weight of the mixture.

The term "the total weight of the compound(s) according to the invention and their salts" as used herein refers in this case to the sum of all compounds according to the invention and
20 all salts thereof, as far as present in the mixture.

Typically, for obtaining a compound according to the invention, madecassoside and/or terminoloside is / are glycosylated. Thus, it is preferred that the mixture comprises madecassoside, wherein the total weight of madecassoside is at most 50 wt.-%, preferably at most 40 wt.-%, particularly preferably at most 30 wt.-%, further preferably at most 25 wt.-%,
25 %, more preferably at most 20 wt.-%, based on the total weight of the mixture.

Additionally or alternatively, the mixture comprises terminoloside, wherein the total weight of terminoloside is at most 50 wt.-%, preferably at most 40 wt.-%, particularly preferably at

most 30 wt.-%, further preferably at most 25 wt.-%, more preferably at most 20 wt.-%, based on the total weight of the mixture.

Additionally or alternatively, the mixture comprises madecassoside and terminoloside, wherein the total weight of madecassoside and terminoloside is at most 50 wt.-%, preferably at most 40 wt.-%, particularly preferably at most 30 wt.-%, further preferably at most 25 wt.-%, more preferably at most 20 wt.-%, based on the total weight of the mixture.

Moreover, the present invention relates to a composition for food or pleasure or pharmaceutical composition comprising one or more compound(s) according the invention or a mixture according to the invention.

Preferably, the composition according to the invention, preferably the pharmaceutical composition according to the invention, may be present in a form selected from the group consisting of tablets (non-coated as well as coated tablets, single or multiple layered tablets), capsules, lozenges, granules, pellets, solid substance mixtures, dispersions in liquid phases, emulsions, powders, solutions, juices, pastes or other swallowable or chewable preparations.

Preferably, the composition according to the invention serving for food or pleasure may be selected from the group consisting of baked goods, for example, bread, dry biscuits, cakes, other baked products, confectionery (for example, chocolate, chocolate bar products, other bar products, fruit gum, hard and soft caramels, chewing gum), alcoholic or nonalcoholic beverages (for example, coffee, tea, iced tea, wine, wine-containing beverages, beer, beer-containing beverages, liqueurs, brandies, (carbonated) fruit-containing beverages, (carbonated) isotonic beverages, (carbonated) soft beverages, nectars, spritzers, fruit and vegetable juices, fruit or vegetable juice formulations, instant beverages (for example, instant cocoa beverages, instant tea beverages, instant coffee beverages, instant fruit beverages), meat products (for example, ham, fresh sausage or uncooked sausage formulations, seasoned or marinated fresh or salted meat products), eggs or egg products (dried egg, egg white, egg yolk), cereal products (for example, breakfast cereals, muesli bars, precooked ready-made rice products), dairy products (for example, milk beverages, buttermilk beverages, milk ice, yoghurt, kefir, fresh cheese, soft cheese, hard cheese, dried milk powder, whey, whey beverages, butter, buttermilk, products containing partly or completely hydrolysed milk protein), products made of soy protein or other soybean fractions (for example, soy milk and products produced thereof, fruit beverages with soy protein, soy lecithin-containing formulations, fermented products such as tofu or tempe or

products produced thereof), products made of other plant-based protein sources, for example, oat protein beverages, fruit preparations (for example, preserves, fruit ice-cream, fruit sauces, fruit fillings), vegetable preparations (for example, ketchup, sauces, dried vegetables, frozen vegetables, precooked vegetables, vegetables preserved in vinegar),
5 snacks (for example, baked or fried potato chips (crisps) or potato dough products, extrudates based on maize or peanuts), fat- and oil-based products or emulsions thereof (for example, mayonnaise, remoulade, dressings), other ready-made dishes and soups (for example dried soups, instant soups, precooked soups), spices or spice formulations and particularly seasonings, which are used, for example, in the snacks sector.

10 Particularly preferred herein are sweets, dairy products and very particularly preferred are non-alcoholic beverages where sweetened beverages are particularly preferred.

Particularly the composition according to the invention may contain one or more further sweeteners and/or one or more further aroma substances.

Preferably, the, one or more or all further sweeteners may be selected from the group
15 consisting of carbohydrates and specifically sugars such as, for example, sucrose/saccharose, trehalose, lactose, maltose, melizitose, raffinose, palatinose, lactulose, D-fructose, D-allulose, D-glucose, D-galactose, L-rhamnose, D-sorbose, D-mannose, D-tagatose, D-arabinose, L-arabinose, D-xylose, D-ribose, D-glyceraldehyde or maltodextrin; synthetic, i.e. usually enzymatically produced, starch or sugar hydrolysates
20 (invert sugar, fructose syrup); fruit concentrates (e.g., on the basis of apples or pears); sugar alcohols (e.g., erythritol, threitol, arabitol, ribitol, xylitol, sorbitol, mannitol, dulcitol, lactitol); proteins (e.g., miraculin, monellin, thaumatin, curculin, brazzein); sweeteners (e.g., magap, sodium cyclamate, acesulfam K, neohesperidin dihydrochalcone, saccharine sodium salt, aspartame, superaspartame, neotame, alitame, sucralose, stevioside,
25 rebaudioside, lugdunane, carrelame, sucrononate, sucrooctate, monatin, phenylodulcin); sweet-tasting amino acids (e.g., glycine, D-leucine, D-threonine, D-asparagine, D-phenylalanine, D-tryptophan, L-proline); further sweet-tasting low-molecular substances such as, e.g., hernandulcin, dihydrochalcon glycoside, particularly, neohesperidin dihydrochalcone, and naringin chalcone, glycyrrhizin, glycyrrhetic acid, their derivatives
30 and salts, extracts of liquorice (*Glycyrrhiza glabra* ssp.), *Lippia dulcis* extracts, *Momordica* ssp. Extracts; individual substances such as, for example, *Momordica grosvenori* [Luo Han Guo] and the mogrosides obtained thereof, *Hydrangea dulcis* or extracts, phyllodulcin; balansins of *Mycetia balansae*.

Also preferably, the, one or more or all further aroma substances may be selected from the group consisting of acetophenone, allyl caproate, alpha-ionone, beta-ionone, aniseed aldehyde, anisyl acetate, anisyl formate, benzaldehyde, benzothiazole, benzyl acetate, benzyl alcohol, benzyl benzoate, beta-ionone, butyl butyrate, butyl capronate, butylidene

5 phthalide, carvone, camphene, caryophyllene, cineol, cinnamyl acetate, citral, citronellol, citronellal, citronellyl acetate, cyclohexyl acetate, cymol, damascone, decalactone, dihydrocoumarin, dimethyl anthranilate, dimethyl anthranilate, dodecalactone, ethoxy ethyl acetate, ethylbutyric acid, ethyl butyrate, ethyl caprinic acid, ethyl capronate, ethyl crotonate, ethyl furaneol, ethylguaikol, ethyl isobutyrate, ethyl isovalerianate, ethyl lactate,

10 ethylmethyl butyrate, ethyl propionate, eucalyptol, eugenol, eugenyl acetate, ethyl heptylate, 4-(p-hydroxyphenyl)-2-butanone, gamma-decalactone, geraniol, geranyl acetate, geranyl acetate, grapefruit aldehyde, methyl dihydrojasmonate (e.g., 5 Hedion®), heliotropin, 2-heptanone, 3-heptanone, 4-heptanone, trans-2-heptenal, cis-4-heptenal, trans-2-hexenal, cis-3-hexenol, trans-2-hexenoic acid, trans-3-hexenoic acid, cis-2-

15 hexenyl acetate, cis-3-hexenyl acetate, cis-3-hexenyl capronate, trans-2-hexenyl capronate, cis-3-hexenyl formate, cis-2-hexyl acetate, cis-3-hexyl acetate, trans-2-hexyl acetate, cis-3-hexyl formate, para-hydroxybenzyl acetone, isoamyl alcohol, isoamyl isovalerianate, isobutyl butyrate, isobutyl aldehyde, isoeugenol methyl ether, isopropyl methyl thiazole, lauric acid, levulinic acid, linalool, linalool oxide, linalyl acetate, menthol,

20 menthofuran, methyl anthranilate, methyl butanol, methyl butyric acid, 2-methyl butyl acetate, methyl capronate, methyl cinnamate, 5-methyl furfural, 3,2,2-methyl cyclopentenolone, 6,5,2-methyl heptenone, methyl dihydrojasmonate, methyljasmonate, 2-methyl methylbutyrate, 2-methyl-2-pentanoic acid, methyl thiobutyrate, 3,1-methyl thiohexanol, 3-methyl thiohexyl acetate, nerol, neryl acetate, trans,trans-2,4-nonadienal,

25 2,4-nonadienol, 2,6-nonadienol, 2,4-nonadienol, nootkatone, delta octalactone, gamma octalactone, 2-octanol, 3-octanol, 1,3-octenol, 1-octyl acetate, 3-octyl acetate, palmitic acid, paraldehyde, phellandrene, pentandione, phenylethyl acetate, phenylethyl alcohol, phenylethyl alcohol, phenylethyl isovalerianate, piperonal, propionaldehyde, propyl butyrate, pulegon, pulegol, sinensal, sulfurol, terpinene, terpineol, terpinolene, 8,3-

30 thiomethanone, 4,4,2-thiomethyl pentanone, thymol, delta-undecalactone, gamma-undecalactone, valencene, valeric acid, vanilline, acetoin, ethyl vanilline, ethyl vanilline isobutyrate (= 3-ethoxy-4-isobutyryloxybenzaldehyde), 2,5-dimethyl-4-hydroxy-3(2H)-furanone and derivatives (here, preferably homofuraneol (= 2-ethyl-4-hydroxy-5-methyl-3(2H)-furanone), homofuronol (= 2-ethyl-5-methyl-4-hydroxy-3(2H)-furanone and 5-ethyl-

35 2-methyl-4-hydroxy-3(2H)-furanone), maltol and maltol derivatives (here, preferably ethyl maltol), coumarine and coumarine derivatives, gamma-lactones (here, preferably gamma-undecalactone, gamma-nonalactone, gamma-decalactone), delta-lactones (here,

preferably 4-methyldeltadecalactone, massoilactone, delta-decalactone, tubero lactone), methyl sorbate, divanilline, 4-hydroxy-2(or 5)-ethyl-5(or 2)-methyl-3(2H)furanone, 2-hydroxy-3-methyl-2-cyclopentenon, 3-hydroxy-4,5-dimethyl-2(5H)-furanone, isoamyl acetate, ethyl butyrate, butyl butyrate, isoamyl butyrate, methyl-3-ethyl butyrate, n-hexanoic acid allyl ester, n-hexanoic acid-n-butyl ester, n-ethyl octanoate, ethyl-3-methyl-3-phenylglycidate, ethyl-2-trans-4-cis-decadienoate, 4-(p-hydroxyphenyl)-2-butanone, 1,1-dimethoxy-2,2,5-trimethyl-4-hexane, 2,6-dimethyl-5-hepten-1-al and phenylacetaldehyde, 2-methyl-3-(methylthio)furan, 2-methyl-3-furanthiol, bis(2-methyl-3-furyl)disulfide, furfuryl mercaptane, methional, 2-acetyl-2-thiazoline, 3-mercapto-2-pentanone, 2,5-dimethyl-3-furanthiol, 2,4,5-trimethylthiazol, 2-acetylthiazol, 2,4-dimethyl-5-ethylthiazol, 2-acetyl-1-pyrroline, 2-methyl-3-ethylpyrazine, 2-ethyl-3,5-dimethylpyrazine, 2-ethyl-3,6-dimethylpyrazine, 2,3-diethyl-5-methylpyrazine, 3-isopropyl-2-methoxypyrazine, 3-isobutyl-2-methoxypyrazine, 2-acetylpyrazine, 2-pentylpyridine, (E,E)-2,4-decadienal, (E,E)-2,4-nonadienal, (E)-2-octenal, (E)-2-nonenal, 2-undecenal, 12-methyltridecanal, 1-Penten-3-one, 4-hydroxy-2,5-dimethyl-3(2H)-furanone, guaiakol, 3-hydroxy-4,5-dimethyl-2(5H)-furanone, 3-hydroxy-4-methyl-5-ethyl-2(5H)-furanone, cinnamon aldehyde, cinnamon alcohol, methyl salicylate, isopulegol; lactisoles, lactisol esters such as described in EP 2,292,224, sodium salts (e.g., sodium chloride, sodium lactate, sodium nitrate, sodium acetate, sodium gluconate), hydroxyflavanones, here, preferably eriodictyol, sterubin (eriodictyol-7-methyl ether), homoeriodictyol, and their sodium, potassium, calcium, magnesium or zinc salts (particularly those as described in EP 1258200 A2) divanillins (particularly those as described in WO 2004/078302) and 4-hydroxydihydrochalcones (preferably as described in US 2008/0227867 A1), here, particularly phloretin and davidigenin, umami compounds as described in WO 2008/046895 A1 and EP 1989944 A1, umami compounds as described in EP 2064959 A1, EP 2,529,632 B1 or EP 2135516 A1, here particularly preferably rubemamine and rubescenamine, vanillyl lignans, particularly preferably lariciresinol or matairesinol as described in WO 2012/146584, enterodiol as described in DE 10 2012 214 560, alkamides, particularly pellitorines as described in EP 2,058,297, EP 1,977,655 B1 and EP 2,008,530 B1, and N-decadienoyl amino acids as described in EP 2,597,082 and their mixtures, as well as stereoisomers, enantiomers, positional isomers, diastereomers, cis/trans-isomers and epimers of these substances.

Preferably in the composition according to the invention, the total weight of the compound(s) according to the invention is in a range of from 0.001 to 60 wt.-%, preferably in a range of from 0.01 to 40 wt.-%, particularly preferably in a range of from 0.1 to 30 wt.-%

%, further preferably in a range of from 0.5 to 20 wt.-%, more preferably in a range of from 1 to 10 wt.-%, based on the total weight of the composition.

The invention further relates to the use of a compound according to the invention or a mixture according to the invention for imparting or modifying a sweet taste impression.

5 Moreover, the invention also relates to a method for imparting and/or modifying a sweet taste impression, comprising the following steps:

- (i) providing a compound according to the invention or a mixture according to the invention,
- (ii) mixing the compound or mixture provided in step (i) with a substance or product, of
10 which a sweet taste impression shall be imparted and/or modified.

The term "modifying a sweet taste impression" as used herein describes any kind of modification, such as optimizing or increasing a sweet taste impression.

Further aspects and advantages of the invention result from the subsequent description of preferred examples.

Examples

Example 1: Production of glucosylated madecassoside with cyclomaltodextrin glucanotransferase

A mixture comprising 95 % of madecassoside (3 g), and maltodextrin (9 g) were dissolved
 5 in 15 mL water and incubated with 1.5 mL of a cyclomaltodextrin glucanotransferase
 (Novozymes, Denmark) at 50 °C for 6 h while shaking, for performing the glycosylation
 reaction. The reaction was inactivated by applying a temperature of 80 °C for 10 min.

After subsequent freeze-drying, the composition of the obtained mixture was analysed via
 HPLC coupled to high resolution mass spectrometry, UV detection and Corona detection
 10 (LC-CAD). The chromatographic separation of the compounds according to the invention
 was performed at a Waters Acquity UPLC Systems (Waters, Eschborn, Germany) with a
 C-18 column (Kinetex, 100 mm x 2.1 mm, 1.7 µm; Phenomenex) at a temperature of 50 °C,
 Water/Acetonitrile with 0.1% formic acid as mobile phase and a flow of 0.55 mL/min. The
 detection was performed with a Bruker microTOFQII mass spectrometer with ESI ionization
 15 at a scanning range of 50 to 2000 Da and a charged aerosol detector (Corona Veo, Thermo
 Scientific, Germany). The area ratios were generally used to calculate the amount ratios of
 the respective compounds, based on the educt concentration.

In addition to non-reacted educt, several glucosylated compounds with R²=rhamnose and
 R¹, R³ to R⁷ = 1 to 8 glucose subunits. The mixture contained the following components

Compounds	Amount [wt.-%]
α-, β-, γ-cyclodextrins	37.52
Maltodextrin	17.32
6a-8a	14.18
9a-12a	7.02
24a-30a	5.55
13a-17a	5.36
1a-5a	4.93
18a-23a	3.76

20

Compounds 1a to 30a correspond to compounds 1a to 30a as in table 1.

Example 2: Production of glucosylated madecassoside with glucansucrase GTF180-Q1140E-ΔN (AAU08001.1)

Transformation of gtf180-Q1140E-ΔN of *Lactobacillus reuteri* in *E. coli*

A pET28a_gtf180Q-1130E-Δ-N vector was synthesized and codon-optimized for *E. coli*
5 K12. The expression plasmide was transformed in E-coli W3110 (ΔDE3).

Production of the recombinant GFT180-Q1140E-ΔN

E.coli W3110 (ΔDE3) including pET28a_gtf180-Q1140E-ΔN was cultured in 15 mL Luria-Bertani Medium (Carl Roth) with 30 µg/mL Neomycin (Carl Roth) at 37 °C, 200 rpm over night in a laboratory shaker. Subsequently, 200 mL Terrific Broth Medium (Carl Roth) with
10 30 µg/mL Neomycin were inoculated at an OD of 0.1 (600 nm) and cultured at 37 °C while shaking. After obtaining an OD of 0.6 to 0.8 (600 nm), the culture was induced with 0.5 mM IPTG and further incubated at 20 °C for 16 to 18 h. The cells were harvested by centrifugation at 17,000 x g for 10 min. Subsequently, the pellet was resuspended in 25 mM sodium citrate buffer pH 4.8 + 1 mM CaCl₂, such that the concentration corresponded
15 to 200 g_{BFM}/L. The cell lysis was performed via ultrasound sonotrode. The cell fragments were separated at 17,000 x g for 10 min.

Biotransformation of madecassoside into glucosylated madecassoside with GFT180-Q1140E-ΔN

10 g/L of a mixture comprising 91 % madecassoside, 70 g/L saccharose and 125 mL
20 clarified cell lysate were filled up with 25 mM sodium citrate buffer pH 4.8 + 1 mM CaCl₂ to 0.5 L and were incubated for 24 h at 37 °C and 200 rpm. The reaction was inactivated by applying a temperature of 80 °C for 30 min and the crude product was obtained.

Purification of glycosylated madecassoside with ion exchange chromatography

100 g polystyrene resin were added to the above reaction mixture and the mixture was
25 incubated for 30 min and 200 rpm at 30 °C. The solids were filtered and it was washed three times with 200 mL deionized water. Subsequently, the mixture was eluted twice with 200 mL of 70 % ethanol and dried by evaporation under vacuum. The residue was dissolved in 100 mL deionised water and the purified product was obtained.

After subsequent freeze-drying, the composition of the obtained mixture was analysed via LC-CAD. The mixture contained the following components

Compounds	Amount [wt.-%] crude product	Amount [wt.-%] purified product
Saccharose	32.32	3.84
Maltodextrin	25.07	70.06
42a-63a	4.66	6.05
31a-33a	3.75	3.42
34a-41a	3.2	3.2
64a	2.06	1.58

Compounds 31a to 64a correspond to compounds 31a to 64a as in table 1.

5 Example 3: Production of glucosylated madecassoside with glycosyltransferase Yjic (AAU23479)

Transformation of Yjic of *Bacillus licheniformis* in *E. coli*

A pET28a_yjic vector was synthesized and codon-optimized for *E. coli* K12. The expression plasmide was transformed in E-coli W3110 (ΔDE3).

10 **Production of the recombinant Yjic**

E.coli W3110 (ΔDE3) including pET28a_Yjic was cultured in 15 mL Luria-Bertani Medium (Carl Roth) with 30 µg/mL Neomycin (Carl Roth) at 37 °C, 200 rpm overnight in a laboratory shaker. Subsequently, 200 mL Terrific Broth Medium (Carl Roth) with 30 µg/mL Neomycin were inoculated at an OD of 0.1 (600 nm) and cultured at 37 °C while shaking. After
 15 obtaining an OD of 0.6 to 0.8 (600 nm), the culture was induced with 0.5 mM IPTG and further incubated at 20 °C for 16 to 18 h. The cells were harvested by centrifugation at 17,000 x g for 10 min. Subsequently, the pellet was resuspended in 100 mM Tris/HCl (pH 7.5) + 2 mM MgCl₂, such that the concentration corresponded to 200 g_{BFM}/L. The cell lysis was performed via ultrasound sonotrode. The cell fragments were separated at 17,000 x g
 20 for 10 min.

Biotransformation of madecassoside into glucosylated madecassoside with Yjic

3 g/L of a mixture comprising 91 % madecassoside, 9.15 g/L UDP-glucose (UDP-Glc) and 35 mL clarified cell lysate were filled up with 100 mM Tris/HCl (pH 7.5) + 2 mM MgCl₂ to 0.7 L and were incubated for 24 h at 37 °C and 200 rpm. The reaction was inactivated by
5 applying a temperature of 80 °C for 30 min and the crude product was obtained.

Purification of glycosylated madecassoside with ion exchange chromatography

80 g polystyrene resin were added to the above reaction mixture and the mixture was incubated for 30 min and 200 rpm at 30 °C. The solids were filtered and it was washed three times with 160 mL deionized water. Subsequently, the mixture was eluted twice with
10 160 mL of 70 % ethanol and dried by evaporation under vacuum. The residue was dissolved in 100 mL deionised water and the purified product was obtained.

After subsequent freeze-drying, the composition of the obtained mixture was analysed via LC-CAD. The mixture contained the following components

Compounds	Amount [wt.-%] crude product	Amount [wt.-%] purified product
UDP-Glc	78.41	16.05
Maltodextrin	15.62	67.25
65a-70a	2.01	9.86

15 Compounds 65a to 70a correspond to compounds 65a to 70a as in table 1.

Example 4: Production of β -1,2-glucosylated madecassoside with oleandomycin glycosyltransferase SaOleDGtf (CAA80301.1)

Transformation of SaOleDGtf of *Streptomyces antibioticus* in *E. coli*

A pET28a_SaOleDGtf vector was synthesized and codon-optimized for *E. coli* K12. The
20 expression plasmide was transformed in E-coli BL21 (λ DE3).

Production of the recombinant SaOleDGtf

E.coli BL21 (λ DE3) including pET28a_SaOleDGtf was cultured in 15 mL Luria-Bertani Medium (Carl Roth) with 30 μ g/mL Neomycin (Carl Roth) at 37 °C, 200 rpm overnight in a

laboratory shaker. Subsequently, 200 mL Terrific Broth Medium (Carl Roth) with 30 µg/mL Neomycin were inoculated at an OD of 0.1 (600 nm) and cultured at 37 °C while shaking. After obtaining an OD of 0.6 to 0.8 (600 nm), the culture was induced with 0.1 mM IPTG and further incubated at 16 °C for 16 to 18 h. The cells were harvested by centrifugation at 17,000 x g for 10 min. Subsequently, the pellet was resuspended in 100 mM Tris/HCl (pH 8), such that the concentration corresponded to 200 g_{BFM}/L. The cell lysis was performed via ultrasound sonotrode. The cell fragments were separated at 17,000 x g for 10 min.

Biotransformation of madecassoside into β-1,2-glucosylated madecassoside with SaOleDGtf

3 g/L of a mixture comprising 91 % madecassoside, 9.15 g/L UDP-glucose (UDP-Glc) and 35 mL clarified cell lysate were filled up with 100 mM Tris/HCl (pH 8) to 0.7 L and were incubated for 24 h at 37 °C and 200 rpm. The reaction was inactivated by applying a temperature of 80 °C for 30 min.

The composition of the obtained mixture was analysed via LC-CAD. The mixture contained the following components

Compounds	Amount [wt.-%]
UDP-Glc	50.93
Maltodextrin	33.34
65a-67a	1.00

Compounds 65a to 67a correspond to compounds 65a to 67a as in table 1.

Example 5: Sensory evaluationExample 5.1 Sweetness modulation

Mixtures according to Examples 1 and 2, as well as fractions thereof were freeze-dried and tasted and sensorically described by flavorists (n=5). The following results were obtained:

No.	Mixture	Dosage [mg/kg]	Method	Evaluation
1	5 % saccharose in water	--	--	Clean, sweet
2	5 % saccharose in water + mixture comprising 91 % of madecassoside	100	--	Same as 1
3	5 % saccharose in water + mixture comprising 57 % of compounds 1a to 17a	500	Example 1, crude product	Sweeter than 1
4	5 % saccharose in water + mixture comprising 21 % of compounds 31a to 64a	200	Example 2, crude product	Very sweet, clean, sugar-like, sweeter than 1
5	5 % saccharose in water + mixture comprising 58 % of compounds 6a to 8a and 40 % of compounds 9a to 10a	100	Example 1, purified product	Sweeter than 1
6	5 % saccharose in water + mixture comprising 66 % of compounds 31a to 33a	100	Example 2, purified product	Very sweet, sweetener-like, licorice profile, sweeter than 1

5

Compounds 1a to 64a correspond to compounds 1a to 64a as in table 1.

It was surprisingly found that the compounds according to the invention provide sweetness-modulating attributes, even though the glucoside madecassoside did not show any effect on sweetness.

- 10 The enzymatic transformation of madecassoside according to Example 1 provides compounds 1a to 17a, which increase the sweetness of the 5 % saccharose solution (Test

no. 3). Particularly, compounds 6a to 10a increase the sweetness of the 5 % saccharose solution (Test no. 5).

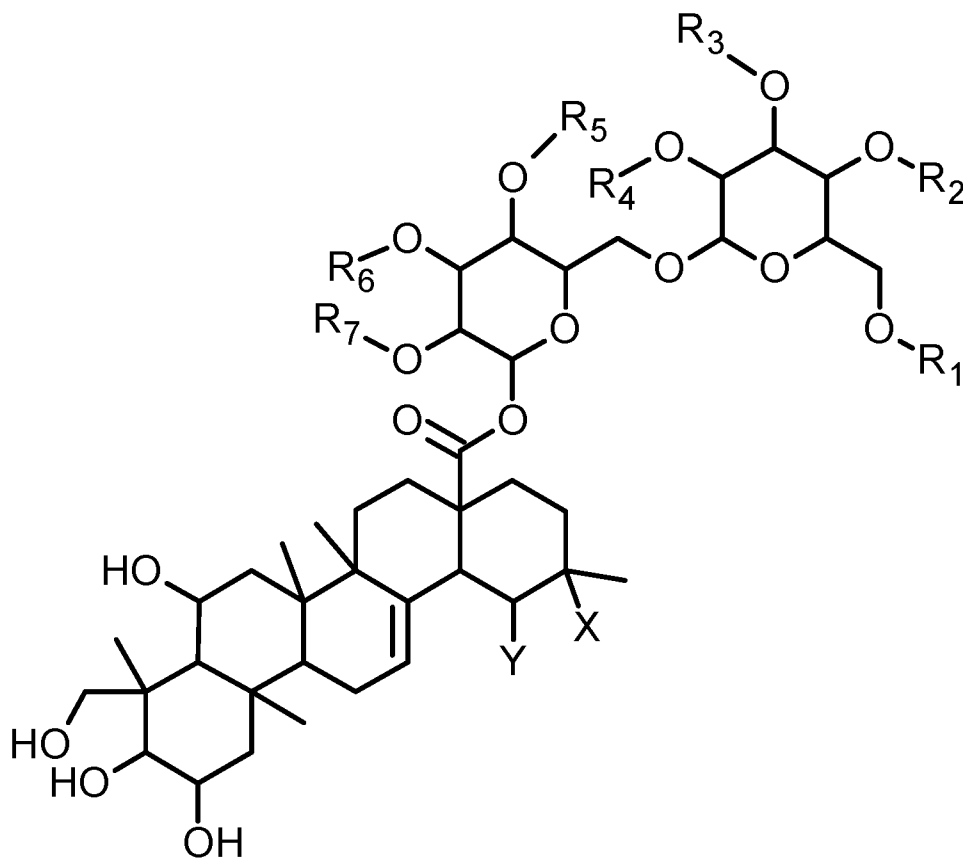
It was surprisingly found that an enzymatic transformation of madecassoside according to Example 2 provides compounds 31a to 64a, which particularly strongly (even stronger than
5 according to Example 1) increase the sweetness of the 5 % saccharose solution (Test no. 4). Particularly, compounds 31a to 33a increase the sweetness of the 5 % saccharose solution (Test no. 6).

Example 5.2: Intrinsic sweetness

For determining the sweetness of the compounds according to the invention, different
10 concentrations of mixture no. 6 according to Example 5.1 were compared to 1.5 % saccharose solution in water in a 2-AFC test (2-Alternative Forced Choice Test; also known as Directional Difference Test or Paired Comparison Test). The determination according to ASTM Designation E2164-08: Standard Test Method for Directional Difference Test (n=30 panellists) revealed an intrinsic sweetness of 120 mg/kg in water. It was surprisingly found
15 that the compounds provided a sweet taste. However, the sweet taste was not stronger than the 1.5 % saccharose solution.

Claims

1. Compound according to formula (I):



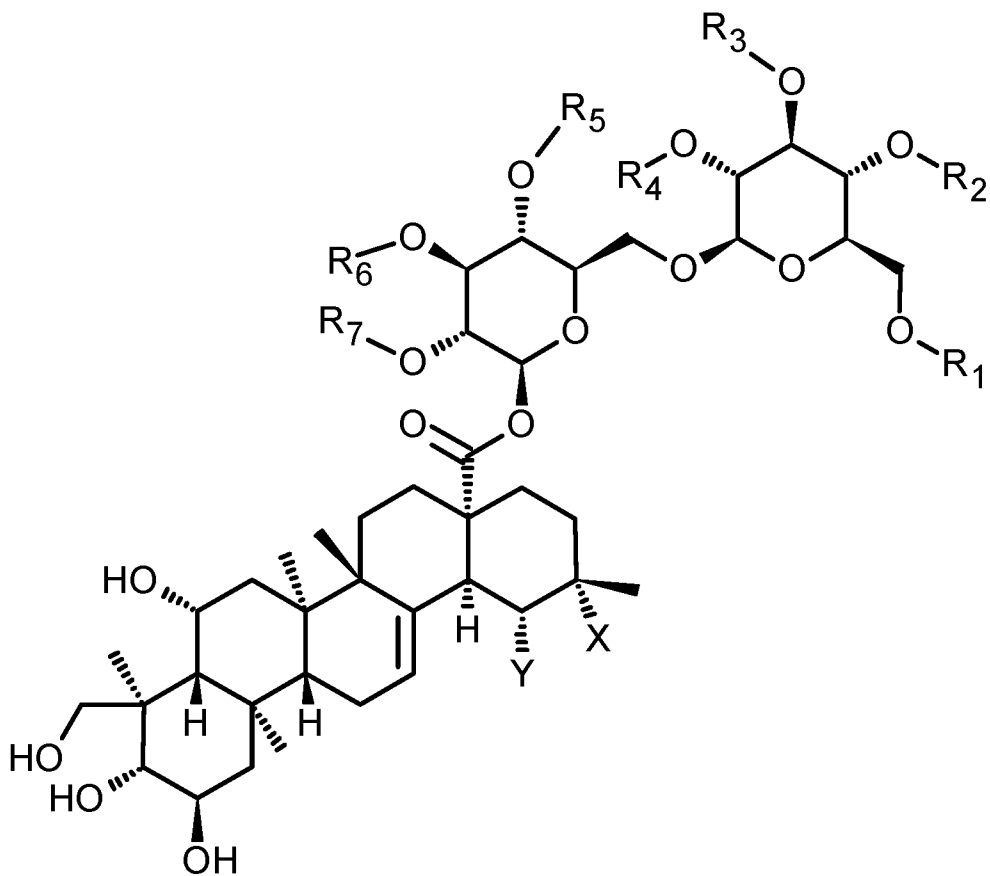
wherein X and Y are selected from hydrogen or CH₃, wherein only one of X and Y is CH₃,

wherein R¹ to R⁷ are selected from hydrogen or a saccharide, wherein the or all monomer subunit(s) of the saccharide is / are monomer(s) selected from the group consisting of glucose, galactose, fructose, rhamnose, xylose, glucuronic acid, quinovose, arabinose and mixtures thereof,

wherein R¹ to R⁷ are selected such that the compound comprises a sum of at least two monomer subunit(s) represented by one or more of R¹ to R⁷,

or a salt thereof.

2. Compound according to claim 1, wherein the compound is of formula (Ia):



wherein X and Y are selected from hydrogen or CH₃, wherein only one of X and Y is CH₃,

wherein R¹ to R⁷ are selected from hydrogen or a saccharide, wherein the or all monomer subunit(s) of the saccharide is / are monomer(s) selected from the group consisting of glucose, galactose, fructose, rhamnose, xylose, glucuronic acid, quinovose, arabinose and mixtures thereof,

wherein R¹ to R⁷ are selected such that the compound comprises a sum of at least two monomer subunit(s) represented by one or more of R¹ to R⁷,

or a salt thereof.

3. Compound according to any one of claims 1 or 2, wherein the compound is selected from compounds 1a to 70b according to the following table, with Rha = rhamnose and Glc = glucose:

No.	R ¹	R ²	R ³	R ⁴	R ⁵	R ⁶	R ⁷	X	Y
1a	H	α -1->4 Rha; α -1->4 Glc	H	H	H	H	H	H	CH ₃
2a	H	α -1->4 Rha	H	H	α -1->4 Glc	H	H	H	CH ₃
3a	H	α -1->4 Rha	H	H	H	α -1->3 Glc	H	H	CH ₃
4a	H	α -1->4 Rha; α -1->3 Glc	H	H	H	H	H	H	CH ₃
5a	H	α -1->4 Rha	α -1->3 Glc	H	H	H	H	H	CH ₃
6a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	H	CH ₃
7a	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc	H	H	H	CH ₃
8a	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
9a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	H	CH ₃
10a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	H	CH ₃
11a	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
12a	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
13a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	H	CH ₃
14a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	H	CH ₃
15a	H	α -1->4 Rha;	H	H	α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃

		α -1->4 Glc; α -1->4 Glc							
16a	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
17a	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
18a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	H	CH ₃
19a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	H	CH ₃
20a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
21a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
22a	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
23a	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
24a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	H	CH ₃
25a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	H	CH ₃

26a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
27a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
28a	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
29a	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
30a	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	CH ₃
31a	α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	H	CH ₃
32a	H	α -1->4 Rha	H	H	α -1->4 Glc	H	H	H	CH ₃
33a	H	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	H	CH ₃
34a	α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	H	CH ₃
35a	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	H	CH ₃
36a	α -1->6 Glc, α -1->4 Glc	H	H	H	H	H	H	H	CH ₃
37a	α -1->6 Glc	α -1->4 Rha	H	H	α -1->4 Glc	H	H	H	CH ₃
38a	H	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc	H	H	H	H	H	H	CH ₃
39a	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc	H	H	H	H	H	H	CH ₃
40a	H	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc, α -1->4 Glc	H	H	H	CH ₃
41a	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->6 Glc	H	H	H	CH ₃
42a	α -1->6 Glc, α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	H	CH ₃

43a	α -1->6 Glc, α -1->4 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	H	CH ₃
44a	α -1->6 Glc, α -1->6 Glc, α -1->4 Glc	α -1->4 Rha	H	H	H	H	H	H	CH ₃
45a	α -1->6 Glc, α -1->6 Glc	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	H	CH ₃
46a	α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	α -1->4 Glc	H	H	H	CH ₃
47a	α -1->6 Glc, α -1->4 Glc	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	H	CH ₃
48a	α -1->6 Glc, α -1->4 Glc	α -1->4 Rha	H	H	α -1->4 Glc,	H	H	H	CH ₃
49a	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc	H	H	H	H	H	H	CH ₃
50a	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc	H	H	H	H	H	H	CH ₃
51a	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc,	H	H	H	CH ₃
52a	α -1->6 Glc	α -1->4 Rha,	H	H	α -1->4 Glc, α -1->4 Glc	H	H	H	CH ₃
53a	α -1->6 Glc	α -1->4 Rha,	H	H	α -1->4 Glc, α -1->6 Glc	H	H	H	CH ₃
54a	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc, α -1->4 Glc	H	H	H	H	H	H	CH ₃
55a	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc, α -1->6 Glc	H	H	H	H	H	H	CH ₃
56a	H	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc, α -1->4 Glc	H	H	H	H	H	H	CH ₃
57a	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc	H	H	α -1->4 Glc,	H	H	H	CH ₃
58a	H	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc	H	H	α -1->4 Glc,	H	H	H	CH ₃

59a	H	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc, α -1->4 Glc	H	H	H	CH ₃
60a	H	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc, α -1->6 Glc	H	H	H	CH ₃
61a	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->4 Glc, α -1->4 Glc	H	H	H	CH ₃
62a	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->6 Glc, α -1->4 Glc	H	H	H	CH ₃
63a	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->4 Glc, α -1->6 Glc	H	H	H	CH ₃
64a	α -1->6 Glc, α -1->6 Glc, α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	H	CH ₃
65a	H	α -1->4 Rha	H	β -1->2 Glc	H	H	H	H	CH ₃
66a	H	α -1->4 Rha	H	H	H	H	β -1->2 Glc	H	CH ₃
67a	H	α -1->4 Rha, β -1->2 Glc	H	H	H	H	H	H	CH ₃
68a	H	α -1->4 Rha	β -1->3 Glc	H	H	H	H	H	CH ₃
69a	H	α -1->4 Rha	H	H	H	β -1->3 Glc	H	H	CH ₃
70a	H	α -1->4 Rha, β -1->3 Glc	H	H	H	H	H	H	CH ₃
1b	H	α -1->4 Rha; α -1->4 Glc	H	H	H	H	H	CH ₃	H
2b	H	α -1->4 Rha	H	H	α -1->4 Glc	H	H	CH ₃	H
3b	H	α -1->4 Rha	H	H	H	α -1->3 Glc	H	CH ₃	H
4b	H	α -1->4 Rha; α -1->3 Glc	H	H	H	H	H	CH ₃	H
5b	H	α -1->4 Rha	α -1->3 Glc	H	H	H	H	CH ₃	H
6b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	CH ₃	H
7b	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc	H	H	CH ₃	H
8b	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc	H	H	CH ₃	H

9b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	CH3	H
10b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	CH3	H
11b	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
12b	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
13b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	CH3	H
14b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	CH3	H
15b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
16b	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
17b	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
18b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	CH3	H
19b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	CH3	H
20b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	CH3	H

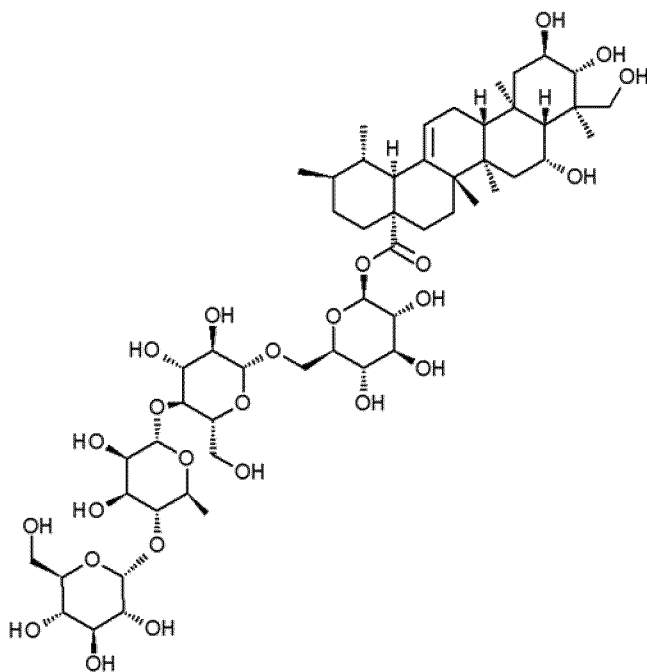
21b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
22b	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
23b	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
24b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	H	H	H	CH3	H
25b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc	H	H	CH3	H
26b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
27b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
28b	H	α -1->4 Rha; α -1->4 Glc; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
29b	H	α -1->4 Rha; α -1->4 Glc	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
30b	H	α -1->4 Rha	H	H	α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc; α -1->4 Glc	H	H	CH3	H
31b	α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	CH3	H

32b	H	α -1->4 Rha	H	H	α -1->4 Glc	H	H	CH3	H
33b	H	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	CH3	H
34b	α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	CH3	H
35b	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	CH3	H
36b	α -1->6 Glc, α -1->4 Glc	H	H	H	H	H	H	CH3	H
37b	α -1->6 Glc	α -1->4 Rha	H	H	α -1->4 Glc	H	H	CH3	H
38b	H	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc	H	H	H	H	H	CH3	H
39b	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc	H	H	H	H	H	CH3	H
40b	H	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc, α -1->4 Glc	H	H	CH3	H
41b	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->6 Glc	H	H	CH3	H
42b	α -1->6 Glc, α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	CH3	H
43b	α -1->6 Glc, α -1->4 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	CH3	H
44b	α -1->6 Glc, α -1->6 Glc, α -1->4 Glc	α -1->4 Rha	H	H	H	H	H	CH3	H
45b	α -1->6 Glc, α -1->6 Glc	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	CH3	H
46b	α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	α -1->4 Glc	H	H	CH3	H
47b	α -1->6 Glc, α -1->4 Glc	α -1->4 Rha, α -1->4 Glc	H	H	H	H	H	CH3	H
48b	α -1->6 Glc, α -1->4 Glc	α -1->4 Rha	H	H	α -1->4 Glc,	H	H	CH3	H
49b	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc	H	H	H	H	H	CH3	H
50b	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc	H	H	H	H	H	CH3	H
51b	α -1->6 Glc	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc,	H	H	CH3	H

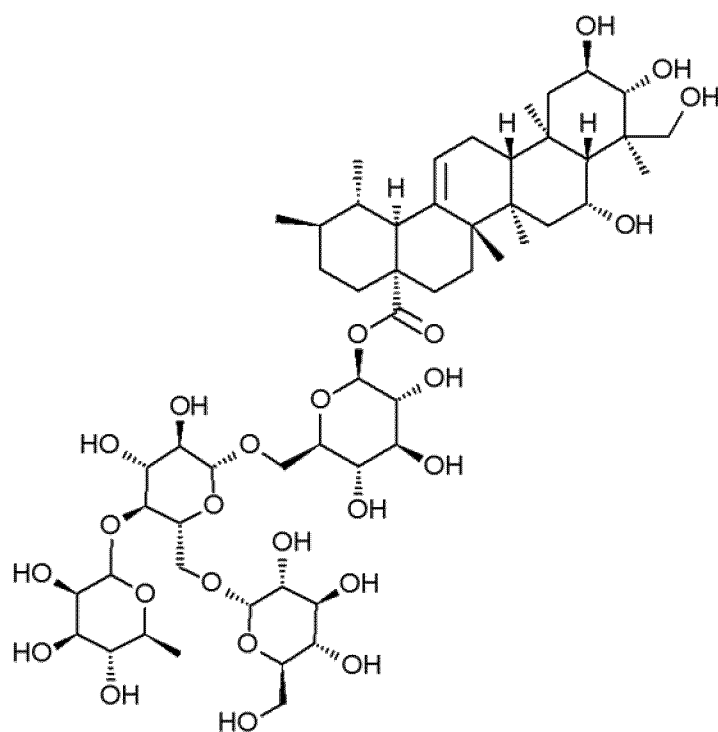
52b	α -1->6 Glc	α -1->4 Rha,	H	H	α -1->4 Glc, α -1->4 Glc	H	H	CH3	H
53b	α -1->6 Glc	α -1->4 Rha,	H	H	α -1->4 Glc, α -1->6 Glc	H	H	CH3	H
54b	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc, α -1->4 Glc	H	H	H	H	H	CH3	H
55b	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc, α -1->6 Glc	H	H	H	H	H	CH3	H
56b	H	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc, α -1->4 Glc	H	H	H	H	H	CH3	H
57b	H	α -1->4 Rha, α -1->4 Glc, α -1->4 Glc	H	H	α -1->4 Glc,	H	H	CH3	H
58b	H	α -1->4 Rha, α -1->4 Glc, α -1->6 Glc	H	H	α -1->4 Glc,	H	H	CH3	H
59b	H	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc, α -1->4 Glc	H	H	CH3	H
60b	H	α -1->4 Rha, α -1->4 Glc	H	H	α -1->4 Glc, α -1->6 Glc	H	H	CH3	H
61b	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->4 Glc, α -1->4 Glc	H	H	CH3	H
62b	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->6 Glc, α -1->4 Glc	H	H	CH3	H
63b	H	α -1->4 Rha	H	H	α -1->4 Glc, α -1->4 Glc, α -1->6 Glc	H	H	CH3	H
64b	α -1->6 Glc, α -1->6 Glc, α -1->6 Glc, α -1->6 Glc	α -1->4 Rha	H	H	H	H	H	CH3	H
65b	H	α -1->4 Rha	H	β -1->2 Glc	H	H	H	CH3	H
66b	H	α -1->4 Rha	H	H	H	H	β -1->2 Glc	CH3	H
67b	H	α -1->4 Rha, β -1->2 Glc	H	H	H	H	H	CH3	H
68b	H	α -1->4 Rha	β -1->3 Glc	H	H	H	H	CH3	H

69b	H	α -1->4 Rha	H	H	H	β -1->3 Glc	H	CH ₃	H
70b	H	α -1->4 Rha, β -1->3 Glc	H	H	H	H	H	CH ₃	H

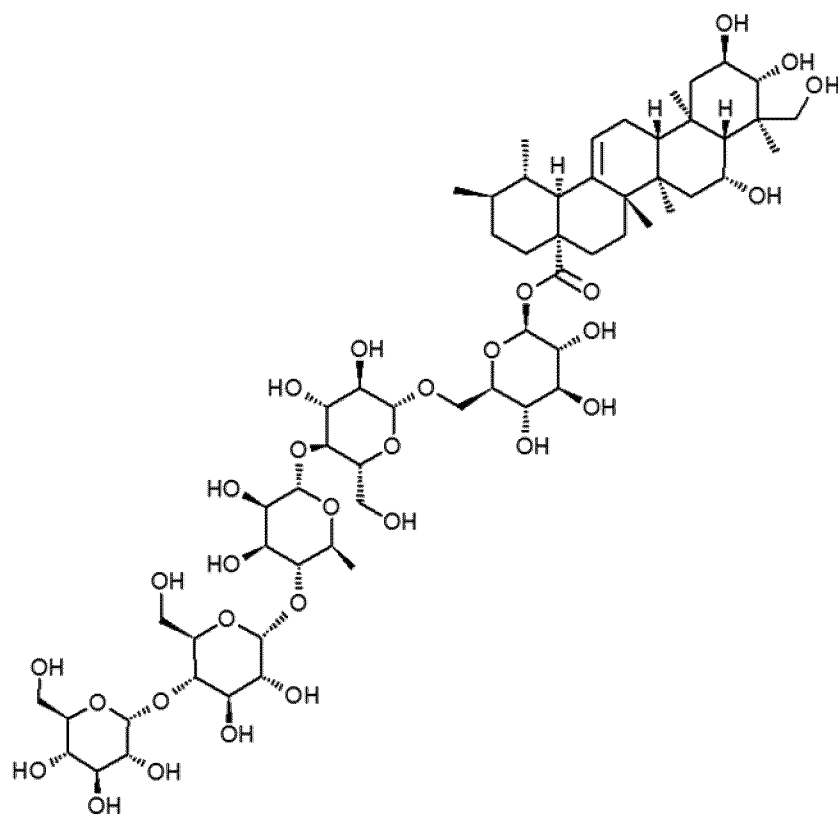
4. Compound according to any one of the preceding claims, wherein the compound is selected from



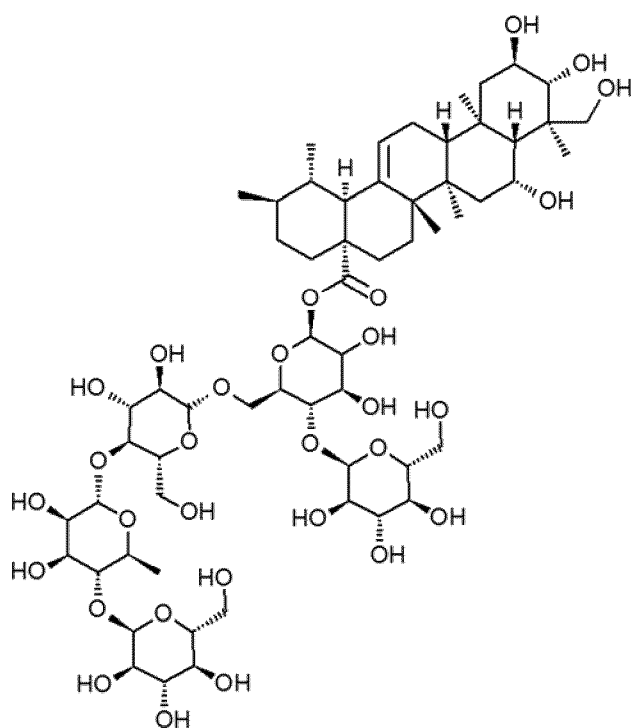
Compound 1a



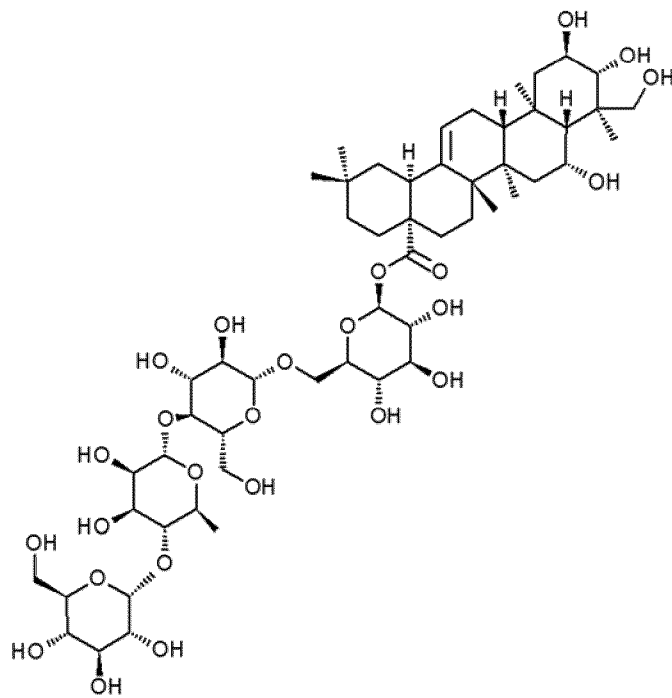
Compound 31a



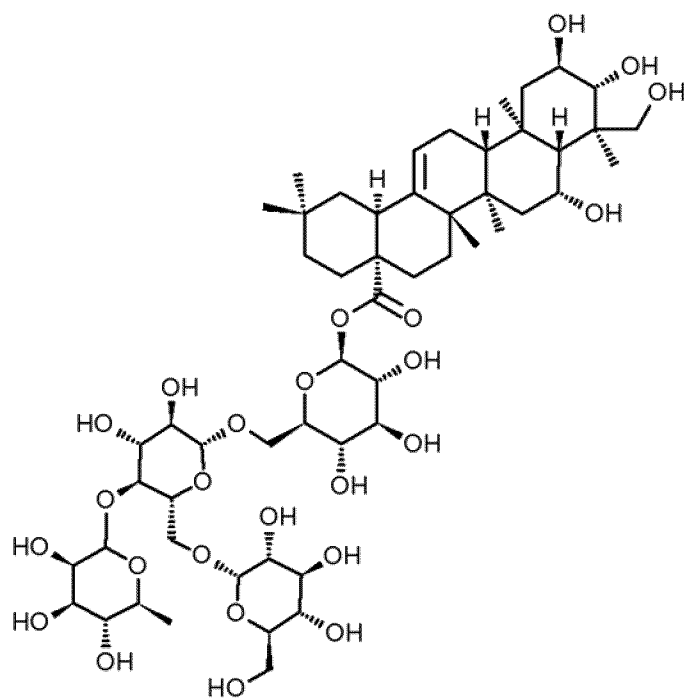
Compound 6a



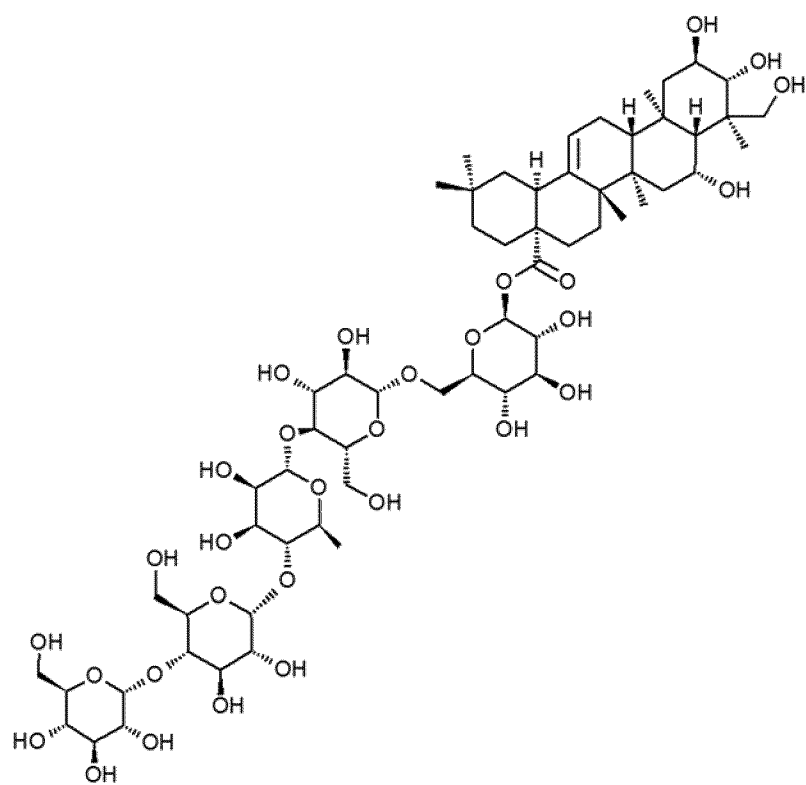
Compound 7a



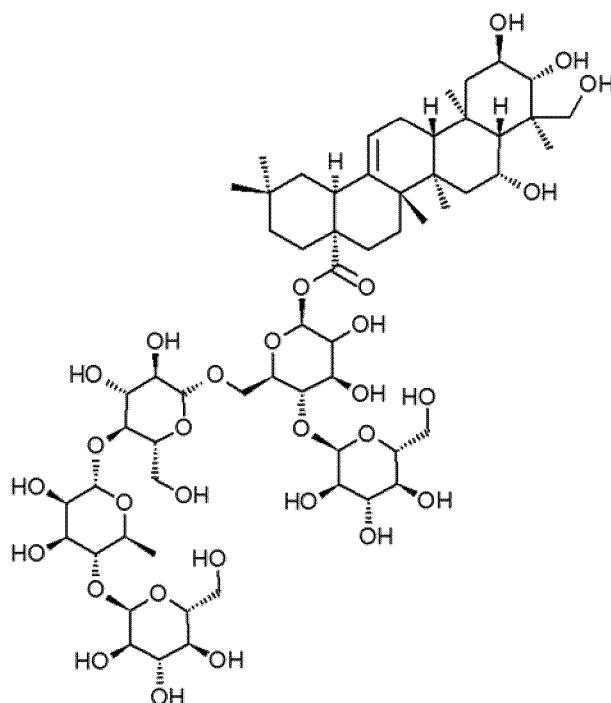
Compound 1b



Compound 31b



Compound 6b



Compound 7b

or any stereoisomer or salt thereof.

5. Method for producing a compound according to one of the preceding claims or a salt thereof, comprising the following steps:
 - (i) providing madecassoside and/or terminoloside, preferably providing a plant extract comprising madecassoside and/or terminoloside, particularly preferably providing a plant extract of *Gotu Kola* comprising madecassoside and/or terminoloside, further preferably providing a plant extract of *Gotu Kola* comprising 50 to 95 wt.-% madecassoside and/or terminoloside, based on the total weight of the plant extract,
 - (ii) providing one or more saccharide(s), preferably wherein the, one or more or all saccharide(s) is / are selected from the group consisting of glucose, galactose, fructose, rhamnose, xylose, saccharose, lactose, UDP-glucose, maltose, starch, maltodextrin, cyclodextrin, glucuronic acid, quinovose, arabinose and mixtures thereof,
 - (iii) providing a glycosyltransferase

(iv) mixing the provided components and incubating the mixed components to obtain a mixture comprising a compound according to one of the preceding claims.

6. Method according to claim 5, wherein the glycosyltransferase provided in step (iii) is selected from the group consisting of glucanotransferases, glucosyltransferases and mixtures thereof,

preferably wherein the glycosyltransferase is selected from the group consisting of α -glucosyltransferases, β -glucosyltransferases, β -1,3-glucosyltransferases, β -fructosidases, α -galactosidases, β -galactosidases, L-rhamnosidases and mixtures thereof,

particularly preferably wherein the glycosyltransferase is selected from the group consisting of cyclomaltodextrin glucanotransferase, glucan sucrose, yjic glucosyltransferase, oleandomycin glycosyltransferase and mixtures thereof.

7. Method according to any one of claims 5 or 6, wherein the, one or more or all saccharide(s) is / are selected from the group consisting of maltodextrin, saccharose and mixtures thereof,

and/or wherein the glycosyltransferase is selected from the group consisting of CTGase, Glucansucrase GTF 180 and mixtures thereof.

8. Method according to any one of claims 5 to 7, wherein the incubation in step (iv) is performed at a temperature in a range of from 30 to 60 °C, preferably in a range of from 35 to 55 °C,

and/or

wherein the incubation in step (iv) is inactivated, preferably by applying a temperature in the range of from 70 to 100 °C, preferably in the range of from 75 to 90 °C, particularly preferably in the range of from 75 to 85 °C,

and/or

wherein the mixture obtained in step (iv) is dried, preferably by a drying method selected from the group consisting of freeze-drying, spray drying, vacuum belt drying or heat drying.

9. Compound according to any one of claims 1 to 4, wherein the compound is obtainable or obtained by a method according to any one of claims 5 to 8, or a salt thereof.

10. Mixture comprising

- (i) one or more compounds according to any one of claims 1 to 4 or 9, or
- (ii) one or more salts according to any one of claims 1 to 4 or 9, or
- (iii) one or more compounds according to any one of claims 1 to 4 or 9 and one or more salts according to any one of claims 1 to 4 or 9,

preferably wherein the mixture is obtained or obtainable by a method according to any one of claims 5 to 8.

11. Mixture according to claim 10, wherein the total weight of the compound(s) according to any one of claims 1 to 4 or 9 and their salts is in a range of from 0.1 to 99 wt.-%, preferably in a range of from 1 to 50 wt.-%, particularly preferably in a range of from 3 to 10 wt.-%, based on the total weight of the mixture.

12. Mixture according to any one of claims 10 or 11, wherein the mixture comprises madecassoside, wherein the total weight of madecassoside is at most 50 wt.-%, preferably at most 40 wt.-%, particularly preferably at most 30 wt.-%, further preferably at most 25 wt.-%, more preferably at most 20 wt.-%, based on the total weight of the mixture,

and/or

wherein the mixture comprises terminoloside, wherein the total weight of terminoloside is at most 50 wt.-%, preferably at most 40 wt.-%, particularly preferably at most 30 wt.-%, further preferably at most 25 wt.-%, more preferably at most 20 wt.-%, based on the total weight of the mixture,

and/or

wherein the mixture comprises madecassoside and terminoloside, wherein the total weight of madecassoside and terminoloside is at most 50 wt.-%, preferably at most 40 wt.-%, particularly preferably at most 30 wt.-%, further preferably at most 25 wt.-%, more preferably at most 20 wt.-%, based on the total weight of the mixture.

13. Composition for food or pleasure or pharmaceutical composition comprising one or more compound(s) according to any one of claims 1 to 4 or 9 or a mixture according to any one of claims 10 to 12.
14. Use of a compound according to any one of claims 1 to 4 or 9 or a mixture according to any one of claims 10 to 12 for imparting or modifying a sweet taste impression.
15. Method for imparting and/or modifying a sweet taste impression, comprising the following steps:
 - (i) providing a compound according to any one of claims 1 to 4 or 9 or a mixture according to any one of claims 10 to 12,
 - (ii) mixing the compound or mixture provided in step (i) with a substance or product, of which a sweet taste impression shall be imparted and/or modified.

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2021/074604

A. CLASSIFICATION OF SUBJECT MATTER INV. C07J63/00 A23L2/60 A23L27/30 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) C07J A23L		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, CHEM ABS Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2018/132514 A1 (RAY ANANDASANKAR [US] ET AL) 17 May 2018 (2018-05-17) compound 168 table 1 page 15 first compound, RN: 2226719-80-6 -----	1-15
X	CN 110 870 870 A (HAWLEY & HAZEL BVI CO LTD) 10 March 2020 (2020-03-10) page 9 -----	1, 2
X	KAI GUIGING ET AL: "Separation mechanism of oleanane and ursane pentacyclic triterpenoid isomers by coordination chromatography", SEPU, vol. 32, no. 3, 1 March 2014 (2014-03-01), pages 235-241, XP055928905, DOI: 10.3724/SP.J.1123.2013.09015 page 236 ----- -/--	1, 2
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
9 June 2022		22/06/2022
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Bourghida, E

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2021/074604

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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