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(54) Benævnelse: **FØDEVAREPRODUKTER MED REDUCERET NATRIUMINDHOLD**

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DESCRIPTION

FIELD

[0001] This invention relates to the use of certain compounds for substituting sodium chloride in a food product.

BACKGROUND

[0002] Sodium chloride, ordinary table salt, is the prototypical compound for eliciting the perception of salty taste. However, attempts to reduce sodium consumption have led investigators to find suitable substitutes for sodium chloride or to reduce sodium chloride amounts, without sacrificing salty taste.

[0003] Salts can elicit complex tastes, including mixtures of sweet, bitter, sour, umami, and salty perceptual components. It is believed that the cations of salts impart the perceptual taste component, while the anions, in addition to contributing to tastes of their own, modify the perception of the taste of the cations. By way of example, sodium and lithium are believed to impart only salty tastes, while potassium and other alkaline earth cations produce both salty and bitter tastes. Among the anions commonly found in foods, the chloride ion is considered to be the least inhibitory to the salty taste, while the citrate anion is more inhibitory.

[0004] Many attempts have been made to provide salty tasting compositions as a substitute for table salt which will give the same or a similar seasoning effect and which are comprised of substantially reduced quantities of sodium chloride. To this end, potassium chloride, ammonium chloride, and similar compounds have been suggested. The use of such salts, and combinations of such salts, leaves much to be desired as to taste. Neither of them individually or in combination positively affects other taste modalities and tastes like sodium chloride. Each alone has a disagreeable taste, as do mixtures of such salts. For example, potassium chloride has a strong aftertaste that is characterized as "bitter" by most people. Ammonium chloride also has a bitter aftertaste.

SUMMARY

[0005] This disclosure describes, among other things, bioactive compounds that elicit or enhance the perception of salty taste, or another complex taste associated with consumption of sodium chloride, or that interact with a receptor or ion channel associated with the perception of salty taste or another complex taste associated with consumption of sodium chloride. In embodiments, the bioactive compounds are taste modulating compounds used as ingredients in food products to elicit or enhance perception of salty taste. In embodiments, the

food products contain lower amounts of sodium than normal. Preferably, the taste modulating compounds are bioactive compounds capable of being derived from natural products. According to this invention at least one compound selected from compounds (10), (12), (13), (16), (29), (33), (36), (37), (41), (43), (44), (45), (48), (53), (56), (62), (66), (73), (82), (83), and (84) described below is used for substituting sodium chloride in a food product.

[0006] One or more embodiments of the compounds, compositions, food products or methods described herein provide one or more advantages over prior compounds, compositions, food products or methods. For example, food products that include one or more taste modulating or salty compounds described herein may have lower sodium content relative to food products that do not include such taste modulating or salty compounds while imparting a similar level of saltiness. This and other advantages will be readily understood from the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

FIG. 1 is a table that provides results of DAP score testing regarding the perception of saltiness of various combinations of compounds in sodium chloride solution.

FIG. 2 is a table that provides results of DAP score testing regarding the perception of saltiness of various combinations of compounds in combination in broth solution.

DETAILED DESCRIPTION

[0008] The present invention relates to the use of at least one compound selected from compounds (10), (12), (13), (16), (29), (33), (36), (37), (41), (43), (44), (45), (48), (53), (56), (62), (66), (73), (82), (83) and (84) described below for substituting sodium chloride in a food product.

[0009] All scientific and technical terms used herein have meanings commonly used in the art unless otherwise specified. The definitions provided herein are to facilitate understanding of certain terms used frequently herein and are not meant to limit the scope of the present disclosure.

[0010] As used in this specification and the appended claims, the singular forms "a", "an", and "the" encompass embodiments having plural referents, unless the content clearly dictates otherwise.

[0011] As used in this specification and the appended claims, the term "or" is generally employed in its sense including "and/or" unless the content clearly dictates otherwise. The term "and/or" means one or all of the listed elements or a combination of any two or more of the listed elements.

[0012] As used herein, "have", "having", "include", "including", "comprise", "comprising" or the like are used in their open ended sense, and generally mean "including, but not limited to". It will be understood that "consisting essentially of', "consisting of", and the like are subsumed in "comprising" and the like. As used herein, "consisting essentially of," as it relates to an composition, product, method or the like, means that the components of the composition, product, method or the like are limited to the enumerated components and any other components that do not materially affect the basic and novel characteristic(s) of the composition, product, method or the like.

[0013] The words "preferred" and "preferably" refer to embodiments of the invention that may afford certain benefits, under certain circumstances. However, other embodiments may also be preferred, under the same or other circumstances. Furthermore, the recitation of one or more preferred embodiments does not imply that other embodiments are not useful, and is not intended to exclude other embodiments from the scope of the disclosure, including the claims.

[0014] Also herein, the recitations of numerical ranges by endpoints include all numbers subsumed within that range (e.g., 1 to 5 includes 1, 1.5, 2, 2.75, 3, 3.80, 4, 5, etc. or 10 or less includes 10, 9.4, 7.6, 5, 4.3, 2.9, 1.62, 0.3, etc.). Where a range of values is "up to" a particular value, that value is included within the range.

[0015] As used herein, a "food product" is a food produced by combining two or more edible ingredients.

[0016] As used herein, a "bioactive compound" is a compound that interacts with a receptor or ion channel associated with the perception of salty taste or another complex taste associated with consumption of sodium chloride

[0017] As used herein, a "taste modulating compound" is a compound that modifies the taste of a food product. By way of example, a taste modulating compound may modify the taste of a food product due to a particular taste imparted by the taste modulating compound, due to a modification of the perceived taste of the food product, or a component thereof, or the like. In embodiments, a taste modulating compound is a salty taste modulating compound.

[0018] As used herein a "salty taste modulating compound" is a compound that, when ingested, (i) elicits or enhances a perception of salty taste alone or in the presence of a salt, such as sodium chloride or (ii) alters the flow of ions through one or more ion channel associated with perception of salty taste. Examples of ion channels associated with the perception of salty taste include the ENaC channel, the TrpV1 channel and the TrpML3 channel.

[0019] As used herein, a compound "derived" from a natural product is a compound that exists in a natural product, whose identity is verified. A synthesized compound may be a compound derived from a natural product, provided that the synthesized compound is a compound that exists in the natural product.

[0020] As used herein, an "isolated" or "purified" compound is a compound that is substantially separated from other components of the source of the compound. For example, if the source of the compound is a natural product an isolated or purified compound may be a compound that is separated from its naturally occurring environment. If the compound is synthesized, the compound may be separated from unreacted reagents, reaction byproducts, solvents, or the like.

[0021] In embodiments, a composition that includes a salty taste modulating compound is perceived as imparting a quantity of saltiness equal to a substantially similar composition that does not include the salty taste modulating compound but that has a higher concentration of the salt. Preferably, the composition that includes the salty taste modulating compound imparts a perception of saltiness equal to the substantially similar composition that does not have the salty taste modulating compound when the composition has about 1% or less salt than the substantially similar composition. For example, the composition that includes the salty taste modulating compound may impart a perception of saltiness equal to the substantially similar composition that does not have the salty compound when the composition has about 2% or less, about 5% or less, about 7% or less, about 8% or less, about 9% or less, about 10% or less, about 11% or less, about 15% or less, about 20% or less, about 30% or less, about 35% or less, about 40% or less, or about 50% or less salt than the substantially similar composition. In other words, one or more salty taste modulating compounds may be present in a food product in an amount sufficient to reduce the amount of a salt, such as sodium chloride, by about 1% or more, about 2% or more, about 5% or more, about 7% or more, about 8% or more, about 10% or more, about 11% or more, about 12% or more, about 15% or more, about 20% or more, about 22% or more, about 25% or more, about 30% or more, about 35% or more, about 40% or more, about 45% or more, about 50% or more, about 55% or more, about 60% or more, about 65% or more, about 70% or more, about 75% or more, about 80% or more, about 85% or more, about 90% or more, about 95% or more, or the like. The reduced salt food product elicits the same or similar perception of saltiness as a substantially similar food product that does not include the one or more salty taste modulating compounds.

[0022] Perception of saltiness may be evaluated in any suitable manner. In embodiments, saltiness is determined by a trained analytical sensory panel. In embodiments, the trained sensory panel determines the saltiness of a composition having a salty taste modulating compound relative to a substantially similar composition having increased sodium chloride content if a trained analytical sensory panel first determines that the composition and the substantially similar composition only differ in taste with regard to saltiness.

[0023] A salty taste modulating compound may be a compound that directly acts to elicit or

enhance the perception of salty taste of a salt or may be a compound that is converted, when ingested, into a compound that directly acts to elicit enhance the perception of salty taste of the salt.

[0024] For the purposes of this disclosure, reference to a compound includes reference to salts of the compound, hydrates of the compound, polymorphs of the compound, isomers of the compound (including constitutional isomers and stereoisomers such as enantiomers and diasteriomers), and the like.

[0025] As used herein, a composition that is "substantially similar" to another composition contains substantially the same concentration of components (e.g., within about 5%) except for the specifically enumerated components that make the compositions different. For example, a composition that includes a salty compound may be substantially similar to a composition that does not have the salty compound, if the components of the compositions, other than the salt and the salty compound, are present in a substantially similar concentration.

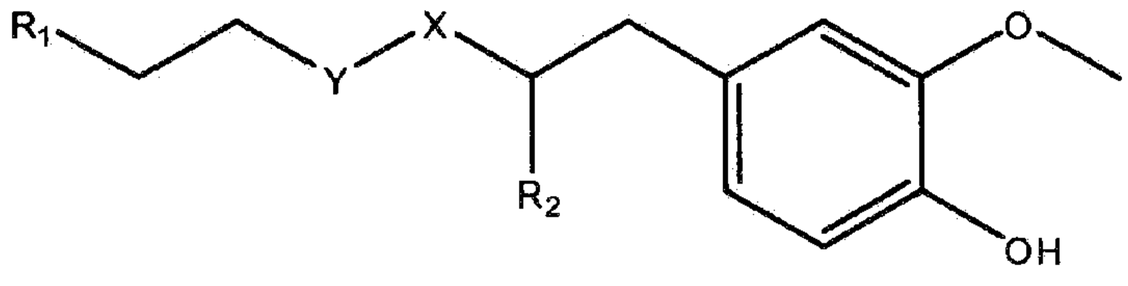
[0026] As used herein, a bioactive, taste modulating or salty taste modulating compound that is derived from a "natural product" is a compound that is extracted from, for example, a plant or microbial source as opposed to being produced synthetically. Extraction or isolation of the naturally-derived bioactive, taste modulating or salty taste modulating compound may be facilitated by simple chemical reactions such as acidification, basification, ion exchange, hydrolysis, and salt formation as well as microbial fermentation, and the like. In embodiments, a bioactive, taste modulating or salty taste modulating compound is derived from natural sources such as natural plant, fungi, and bacterial sources. Examples of such natural sources include, but are not limited to Aesculus hippocastaneum; Alchemilla xanthochlora; Angelica archangelica; Apocynum cannabinum; Azadirachta indica; Actinomycete bacteria (Strain code: 01702axxx000002); Capsicum annuum; Cimicifuga racemosa; Commiphora mukul; Embelia ribes; Evodia rutaecarpa; Ferula assa-foetida; Fungi (Strain code: 02295fxxx000001; Strain code: 01469fxxx000005); Gleditschia australis; Kaempferia galanga; Lavandula officinalis; Marrubium vulgare; Mesua ferrea; Nephelium cuspidatum; Orthosiphon stamineus; Persea gratissima; Petroselinum stativum; Piper longum; Pithecoctenium echinatum; Podophyllum peltatum; Psidium guajava; Ricinus communis; Salvia miltiorrhiza; Schisandea chinensis; Teclea trichocarpa; Vitex agnus; Xysmalobium undulatum; Yucca gloriosa; Zanthoxylum piperitum; Zingiber officinalis; and others. In embodiments, one or more compounds derived from Persea gratissima are combined with one or more compounds derived from Kaempferia galanga or one or more compounds derived from Capsicum annuum; and others.

BIOACTIVE, TASTE MODULATING. AND SALTY TASTE MODULATING COMPOUNDS

[0027] Presented herein are naturally-derived compounds that have been identified eliciting or enhancing the perception of saltiness, and compound classes derived therefrom.

[0028] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a

compound having the following structure (A) which is not within the claims:



(A),

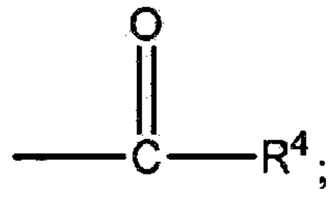
where:

R^1 is H or C_1-C_{10} alkyl;

R^2 is H or C_1-C_3 alkyl;

X is $CHOR^3$ or C=O;

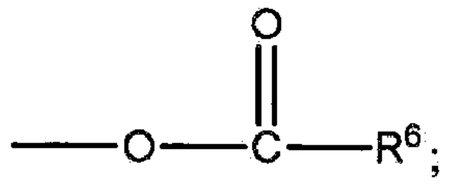
R^3 is H, C_1-C_3 alkyl, or



R^4 is H or C_1-C_3 alkyl;

Y is CR^5=CH or CHR^5-CH_2;

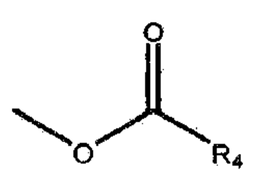
R^5 is H, OH, -OCH_3, -OCH_2CH_3, -O-$OCH_2CH_2CH_3$, or



and

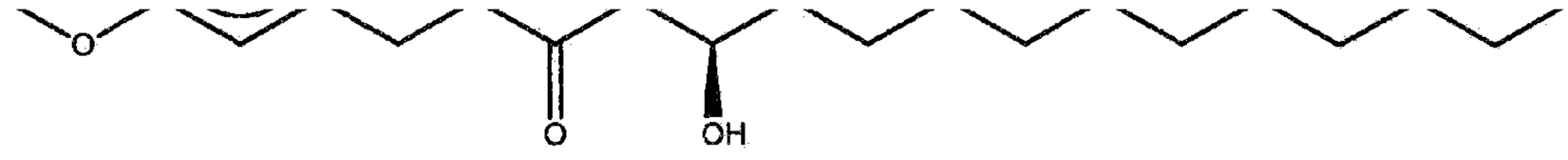
R^6 is H or C_1-C_3 alkyl.

[0029] In embodiments, R^1 is C_2-C_8 alkyl. In embodiments, R^2 is H. In embodiments, X is C=O or

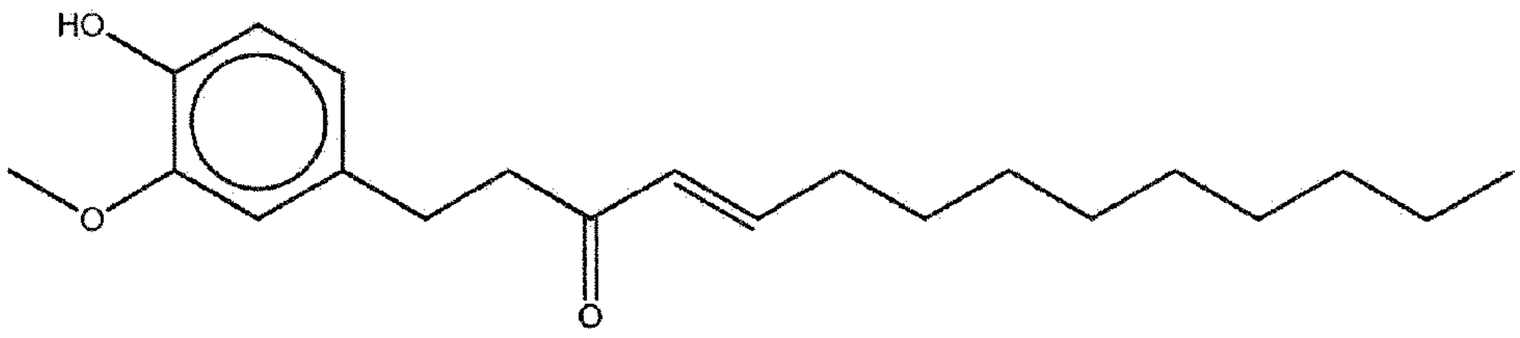


where R^4 is CH_3. In embodiments, when Y is CR^5=CH, R^5 is H. In embodiments, when Y is CHR^5-CH_2, R^5 is OH or -OCH_3. In embodiments, R^6 is CH_3.

[0030] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having one or more of the following structures (which are not within the claims):



(1),



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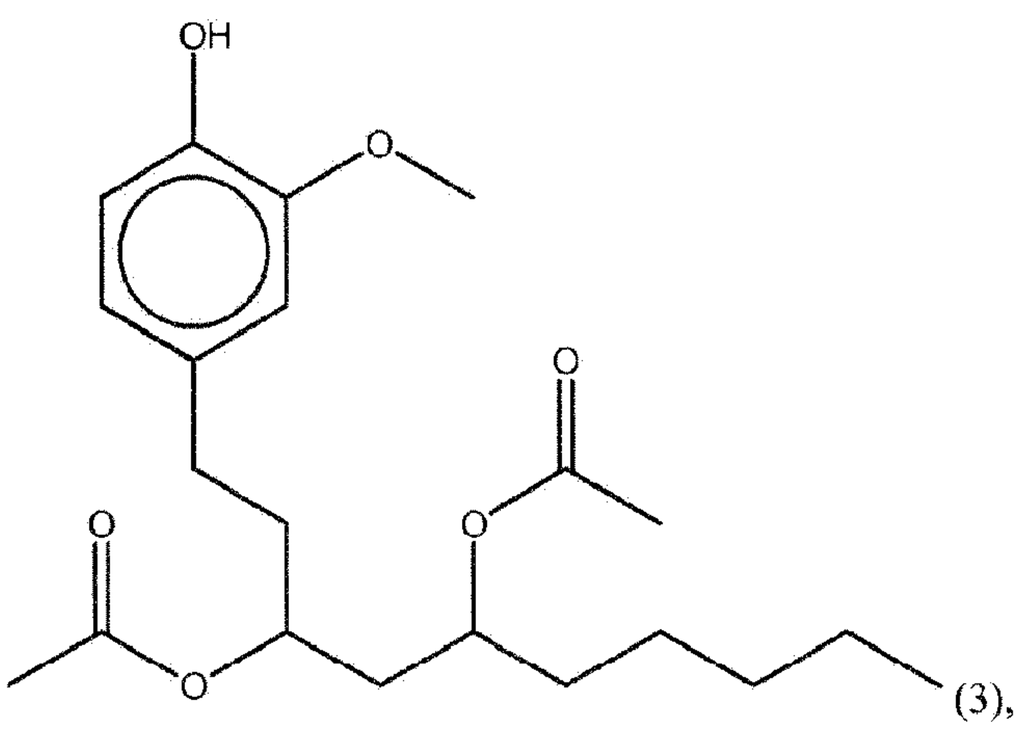

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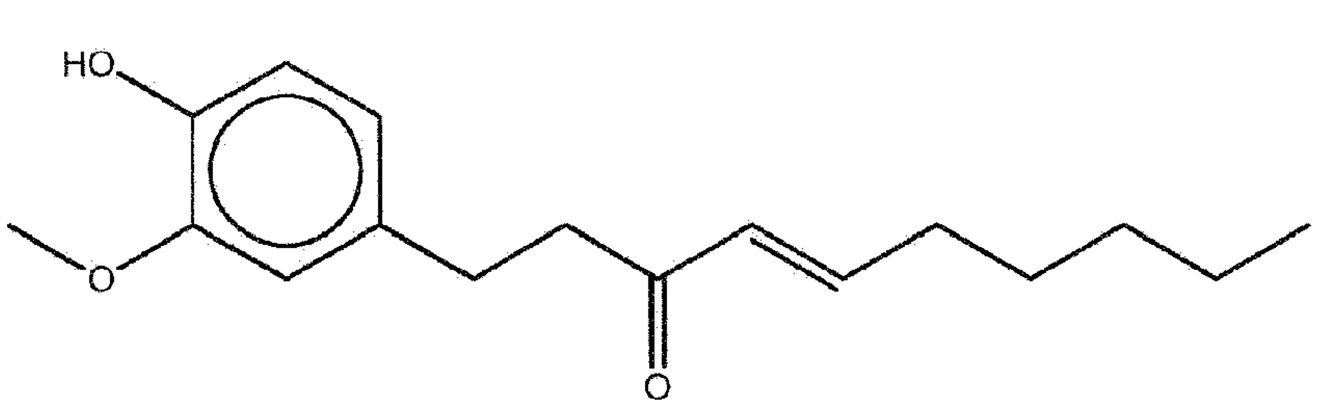

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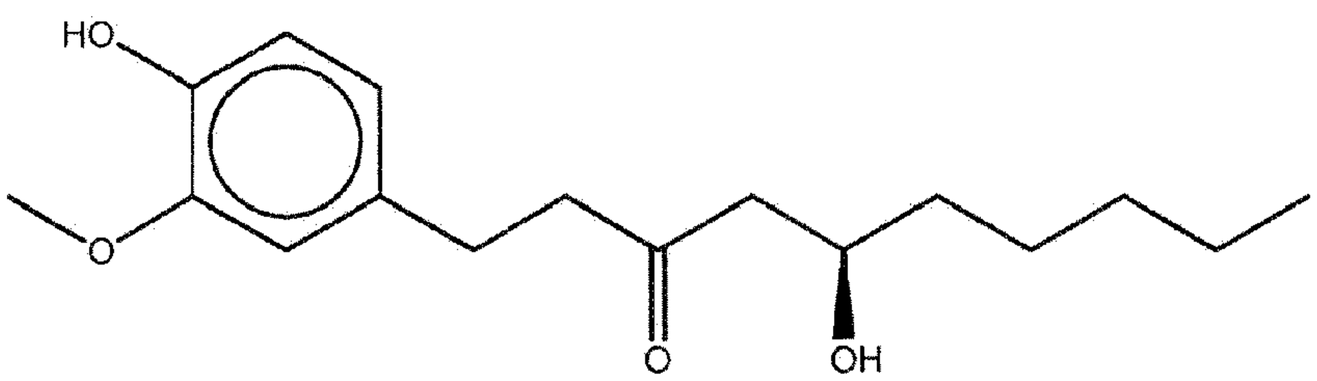

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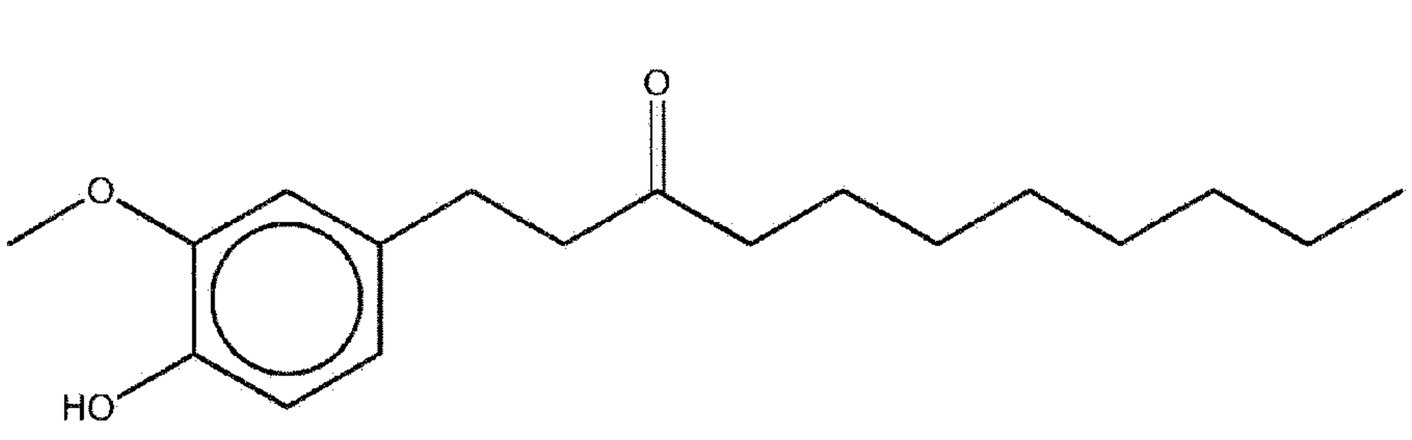

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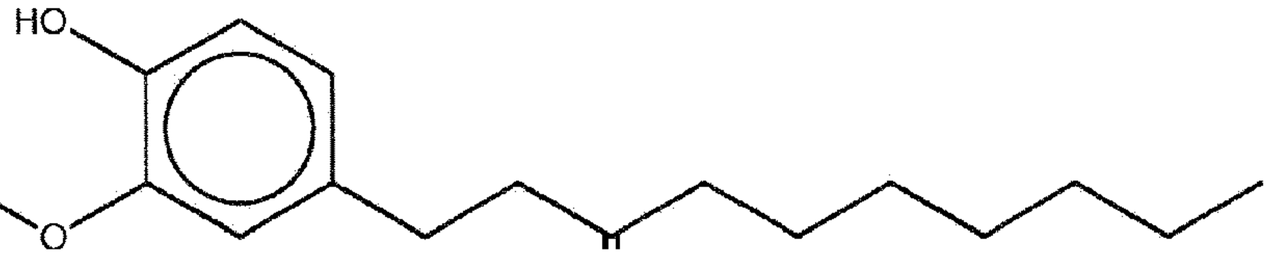
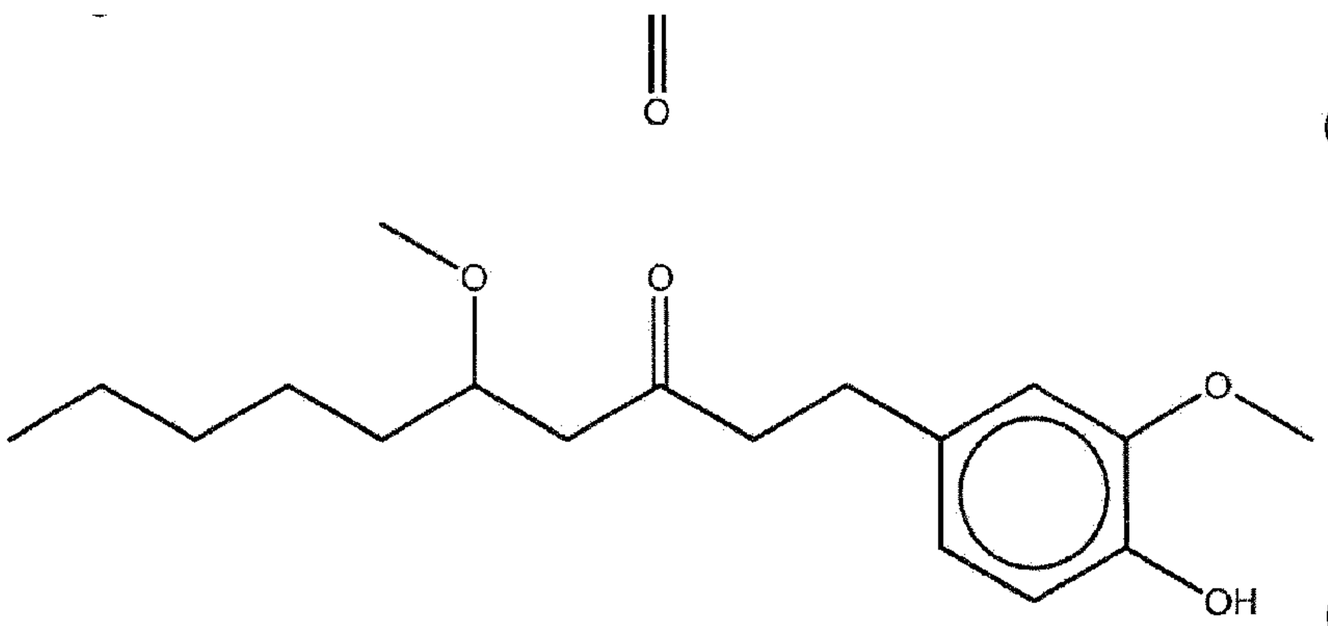
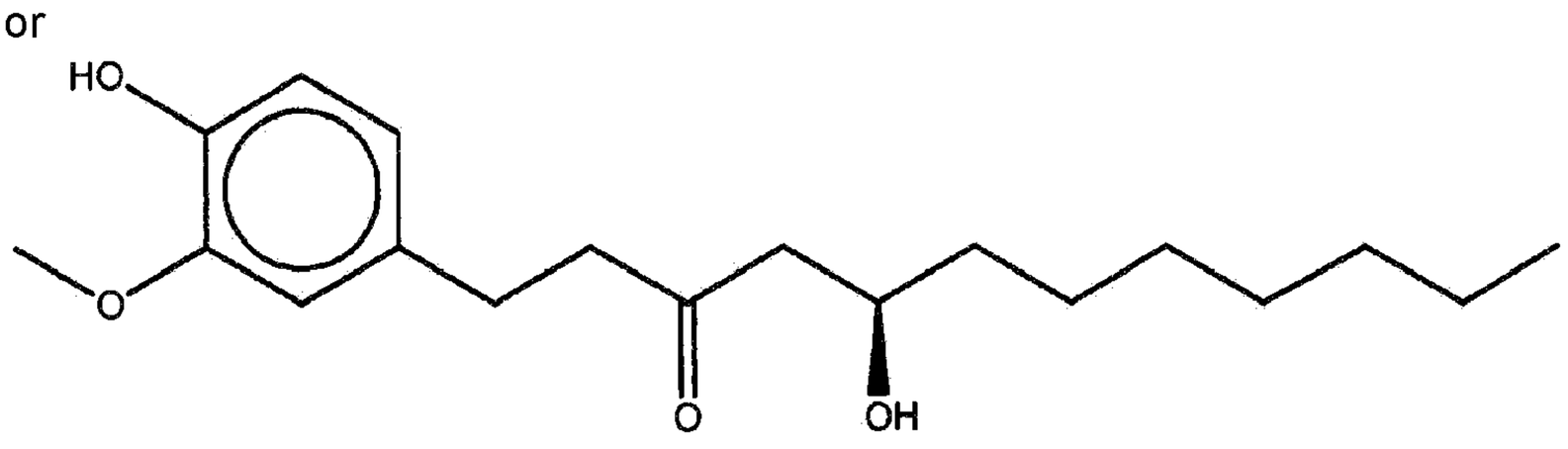




(7),

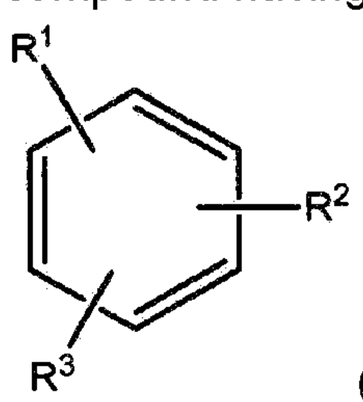
(8),

or



(9)

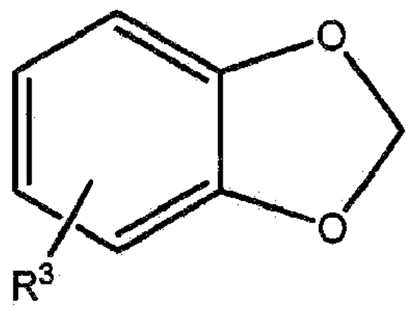
[0031] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (B1):



(B1)

where:

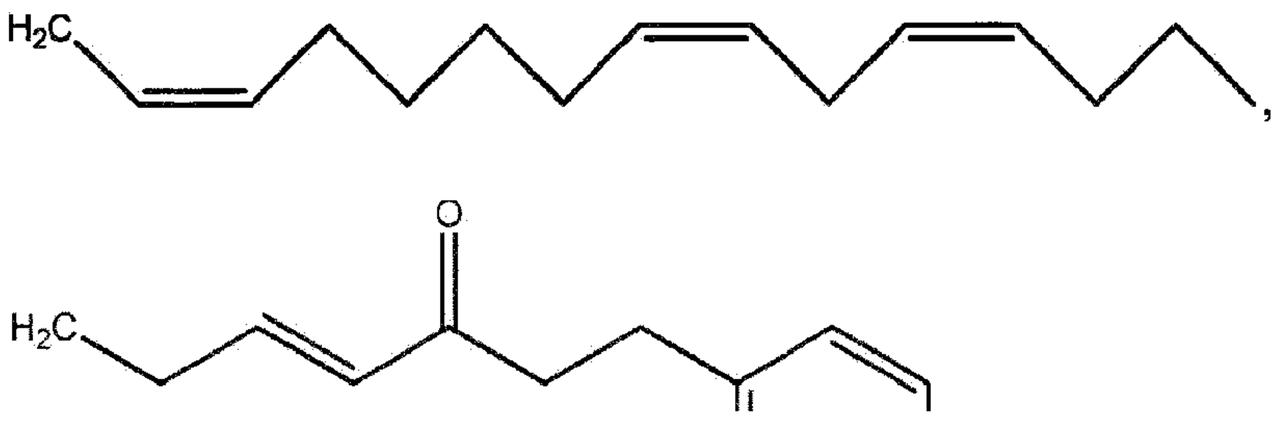
R^1 and R^2 are each independently OH or C_1-C_3 alkoxy or where R^1 and R^2 together with the carbons to which they are bound form a five-membered ring having two oxygen heteroatoms to form a compound having the following structure

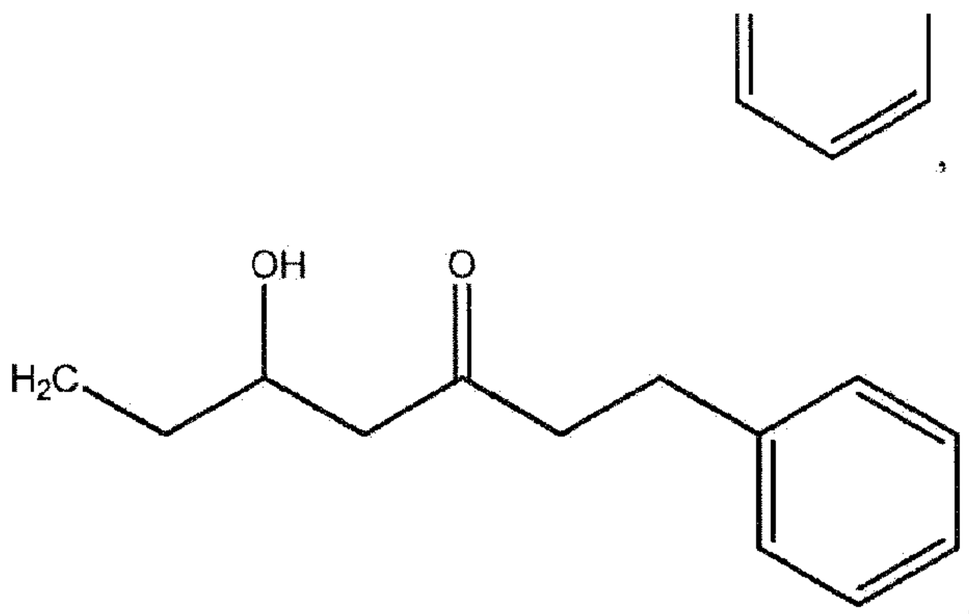


(B1'),

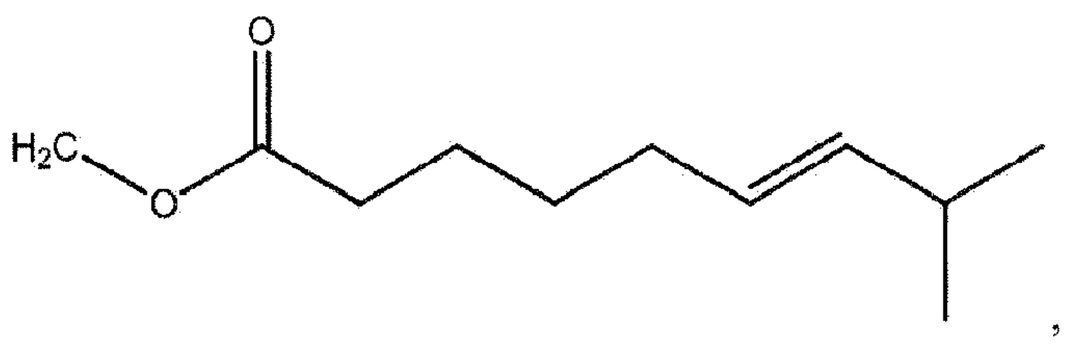
and

R^3 is

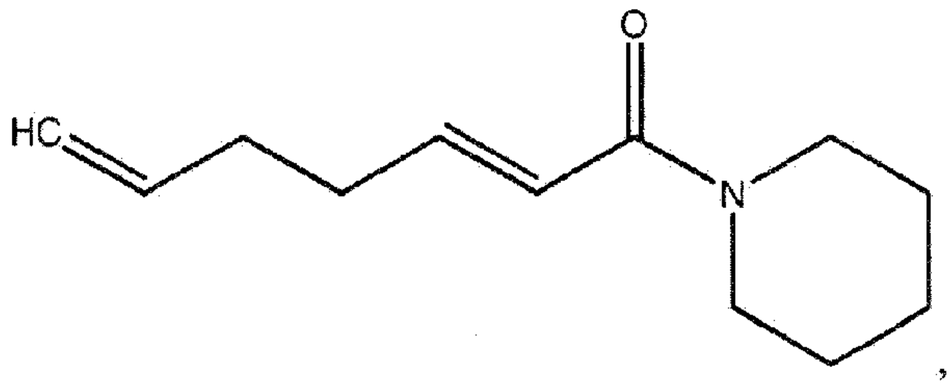



OH
O
H2C

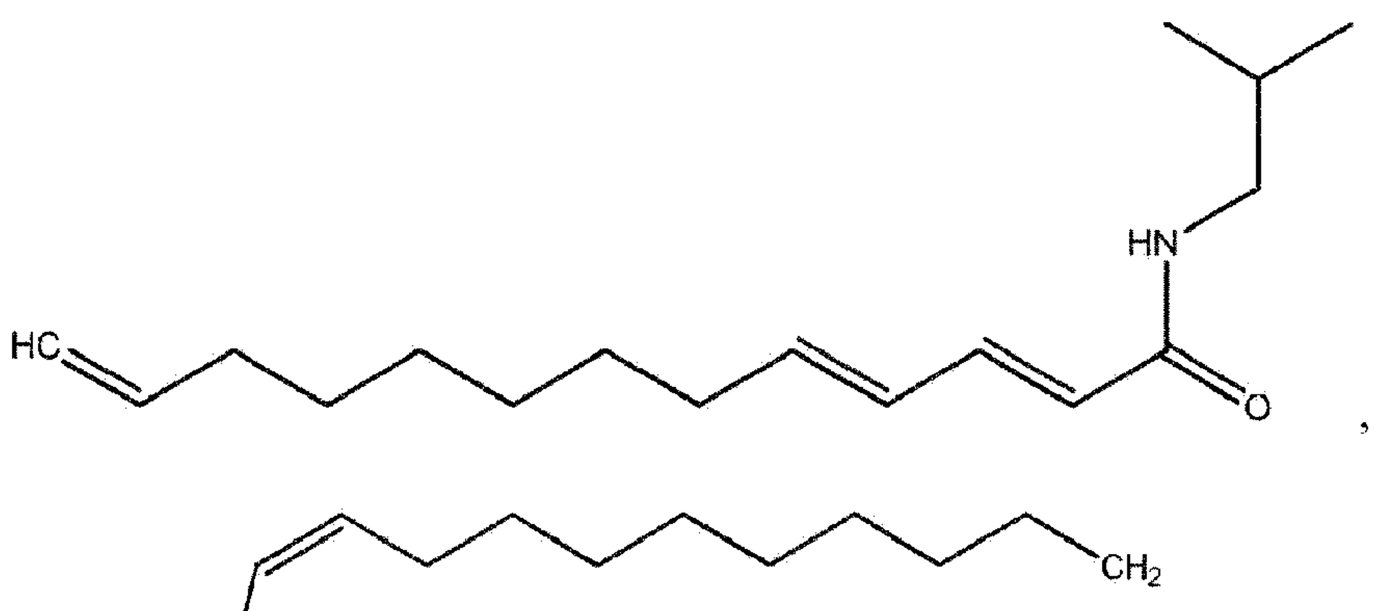
,


O
H2C
O

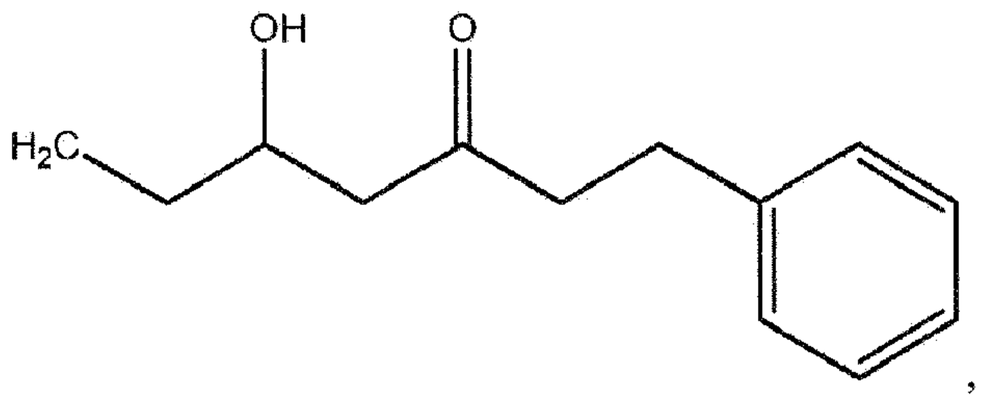
,


O
HC
N

,

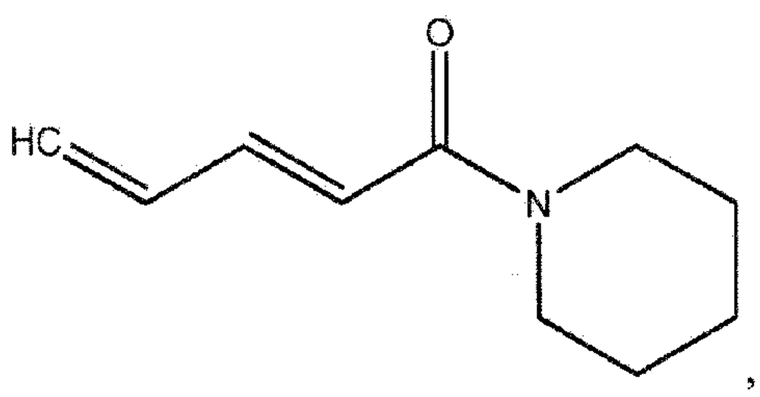

HN
O
HC
CH2

,

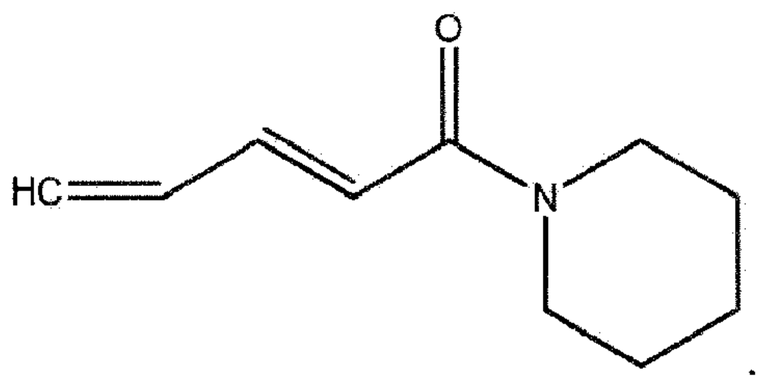

OH
O
H2C

,

H
N

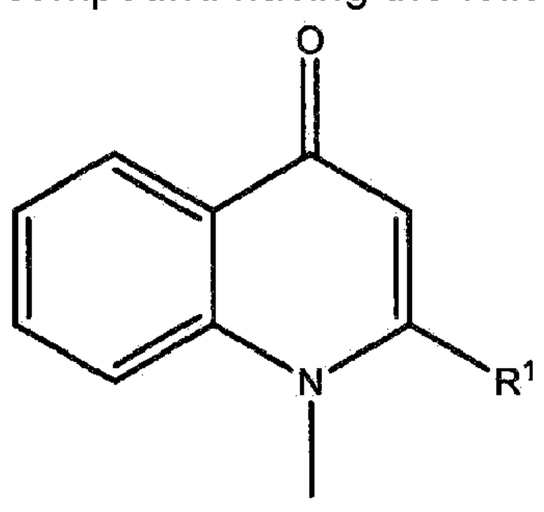


or



Compounds (10), (12), and (13) shown below fall within structure (B1) and fall within the claims.

[0032] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:

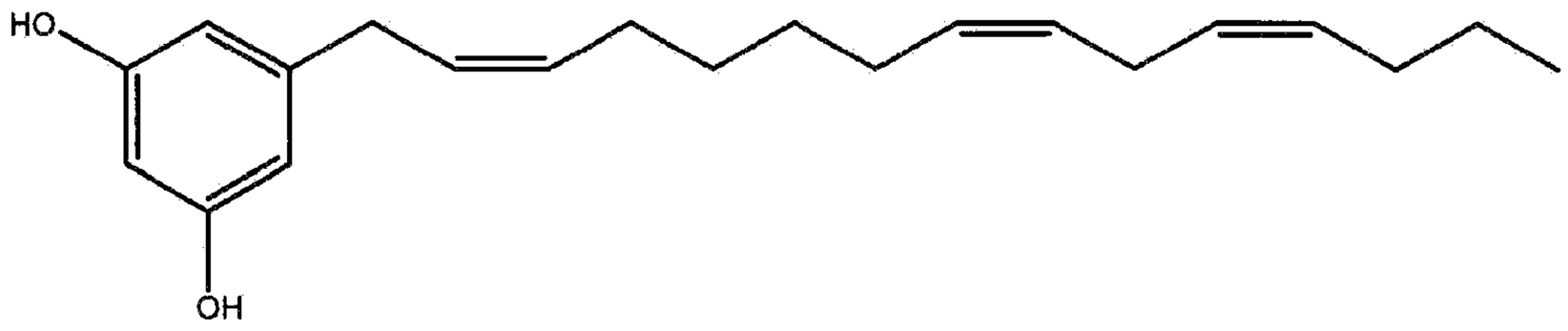


(B2),

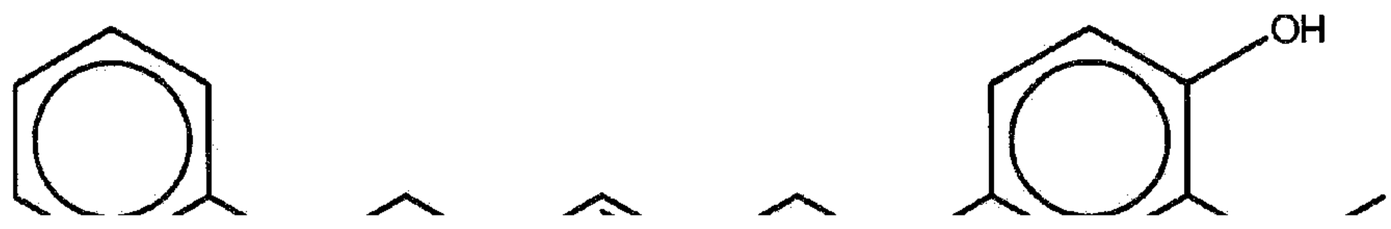
where R^1 is C_{10}-C_{15} alkyl or alkenyl.

Compound (16) shown below falls within structure (B2) and falls within the claims.

[0033] In embodiments, a a bioactive, taste modulating, or salty taste modulating compound is a compound having one or more of the following structures:

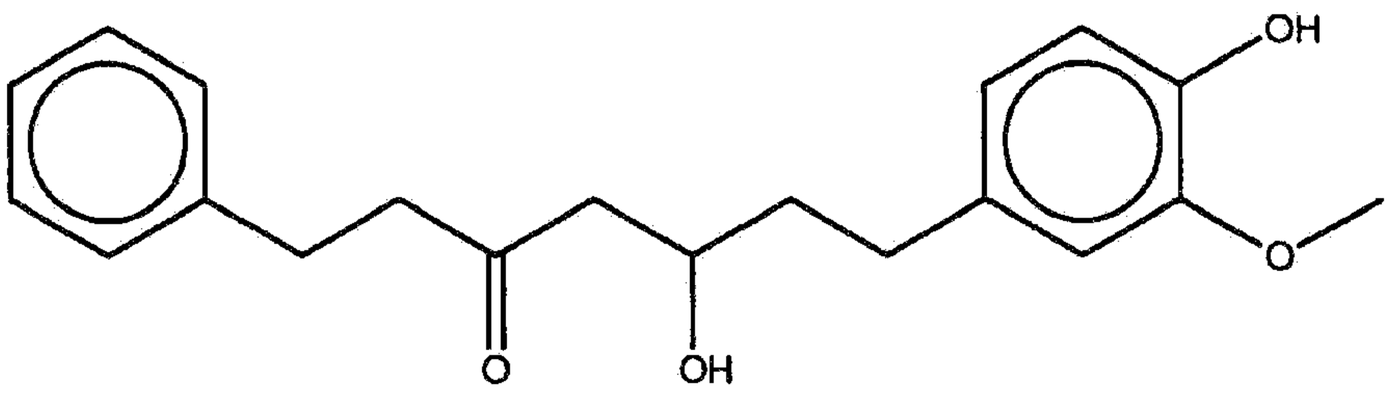


(10),

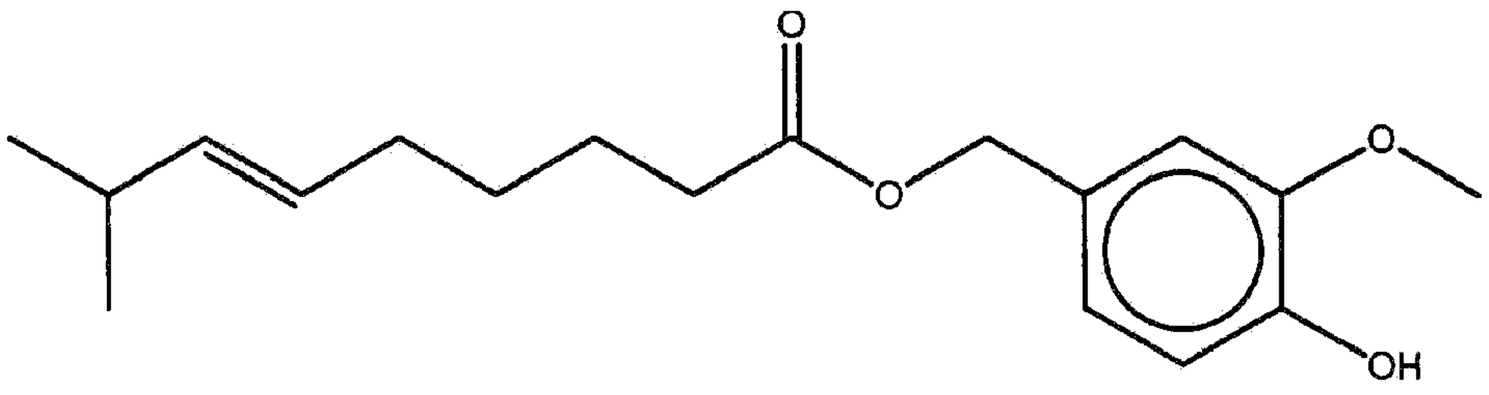


(11), *

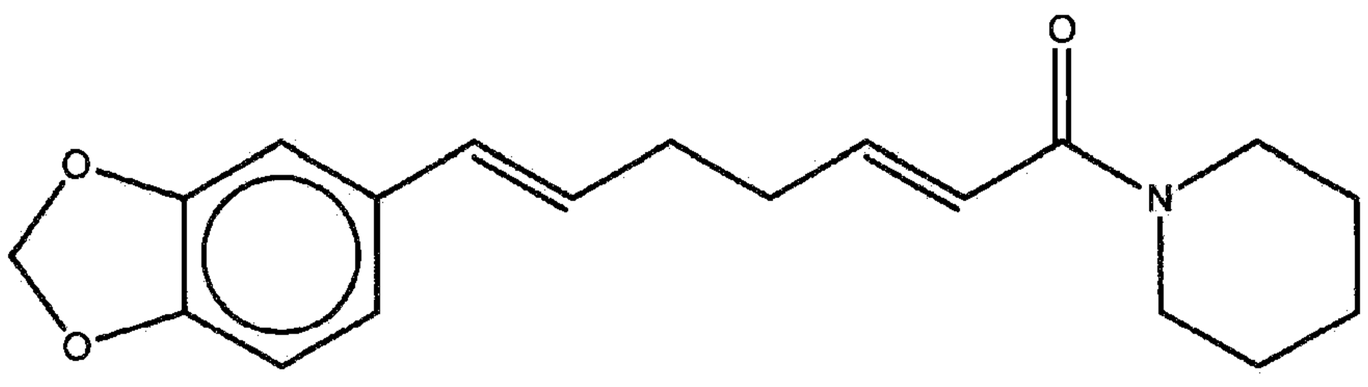
* not within the claims



(12),

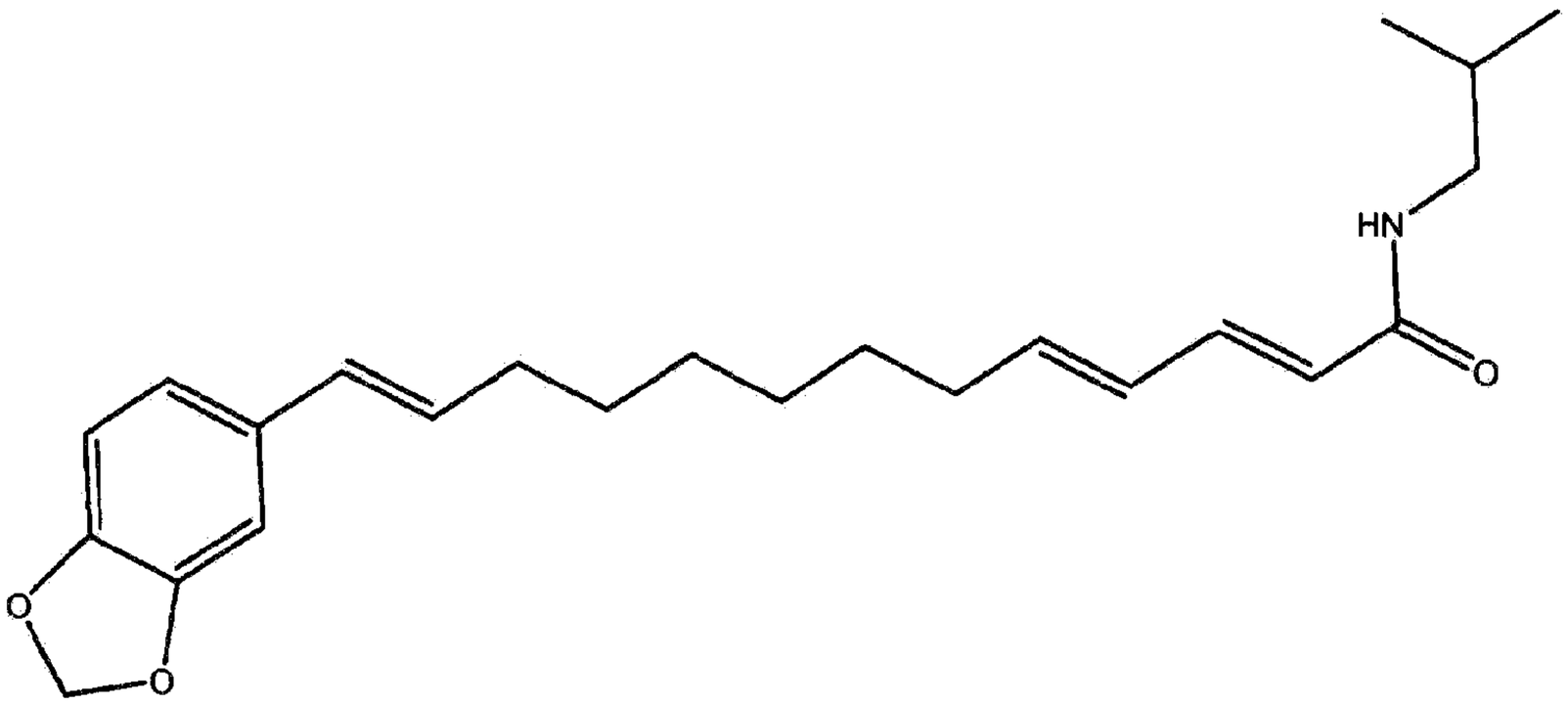


(13),



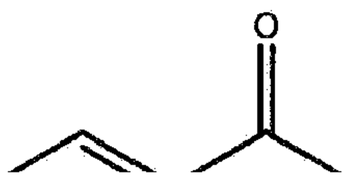
(14), *

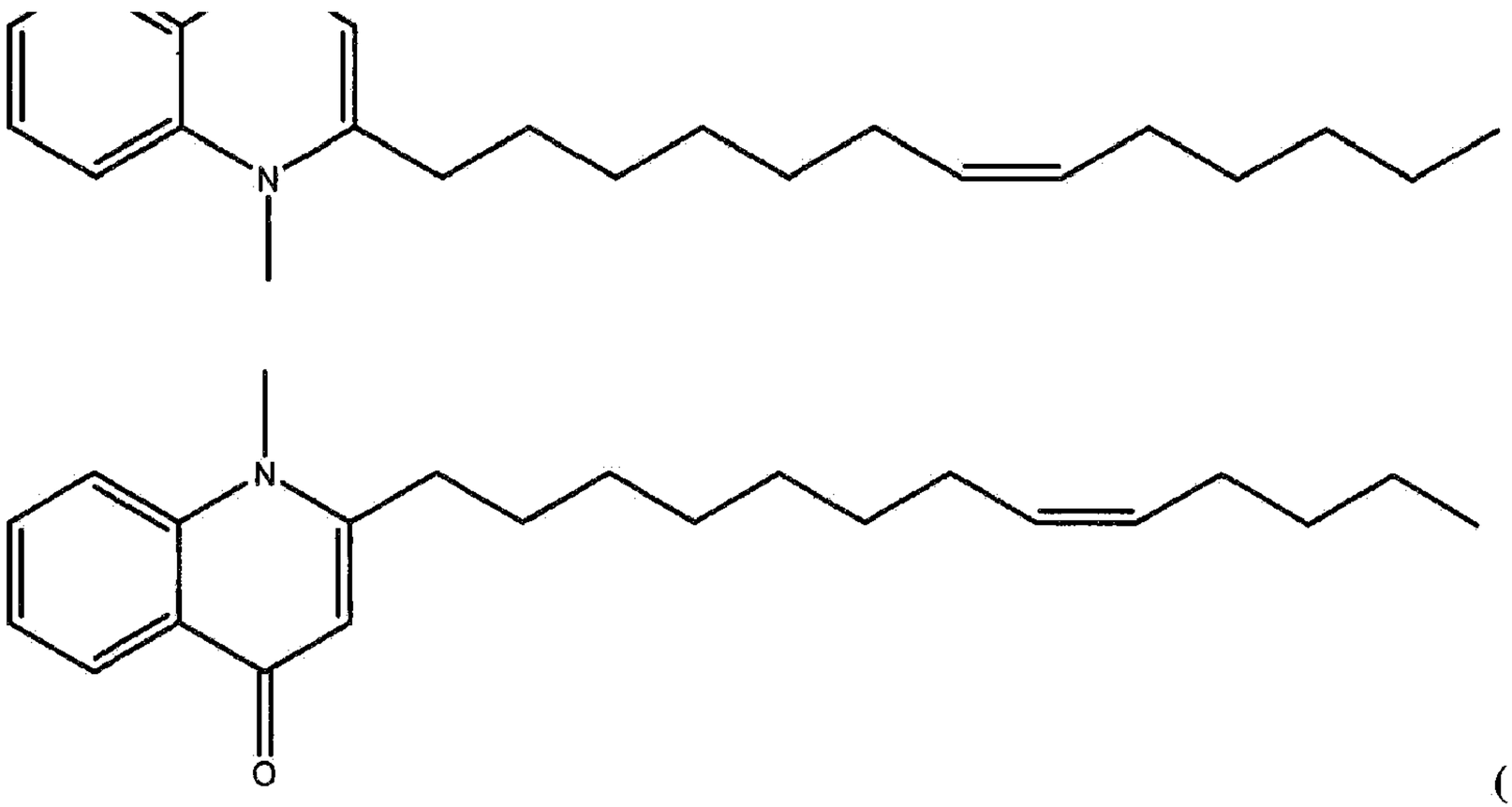
* not within the claims



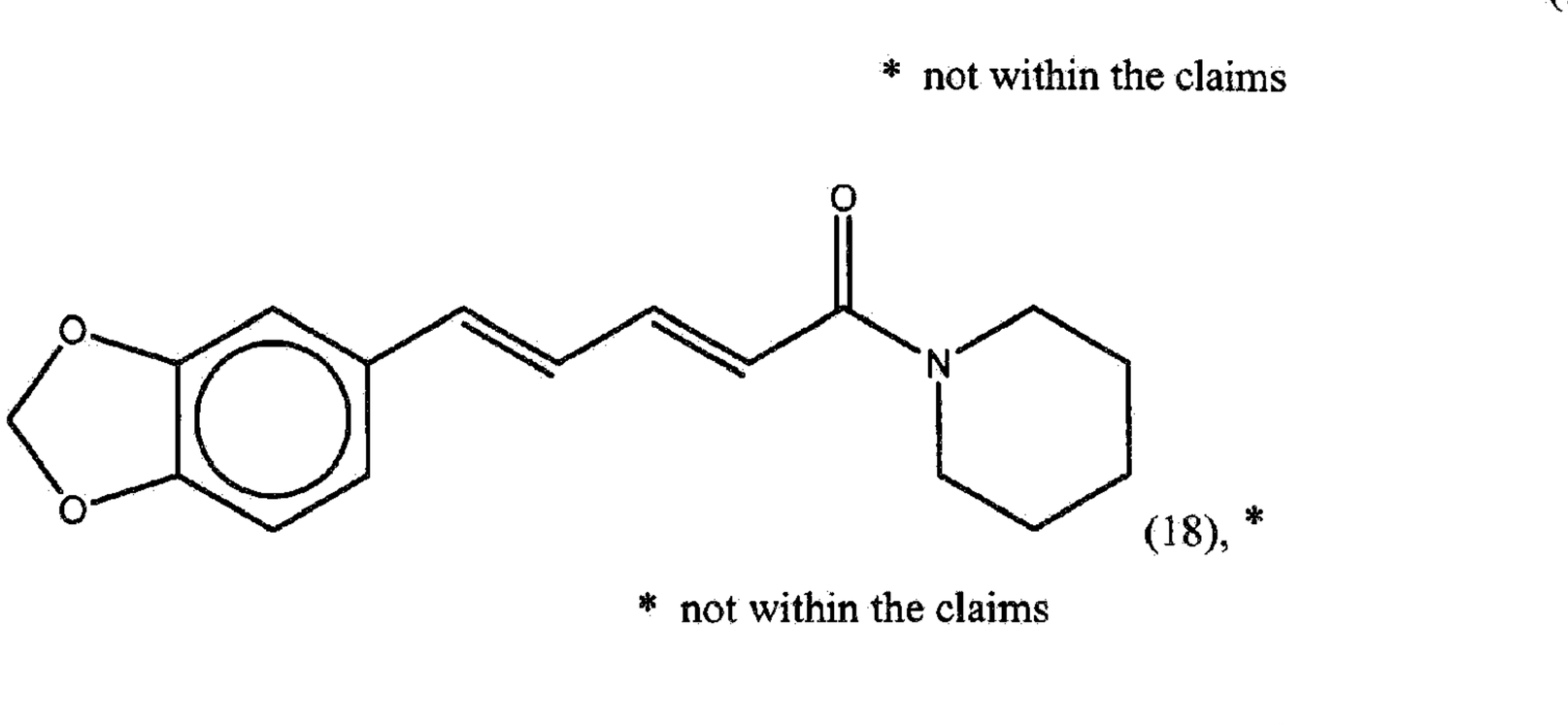
(15), *

* not within the claims



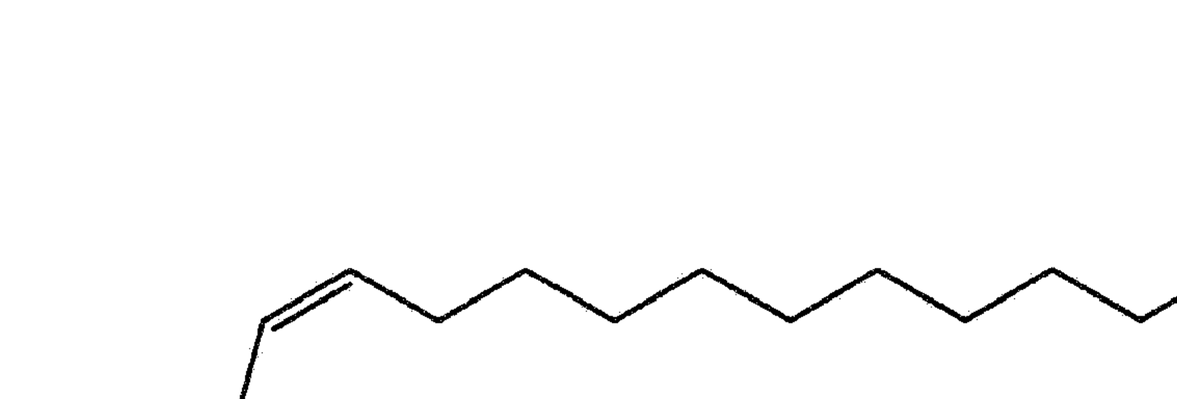


(16),



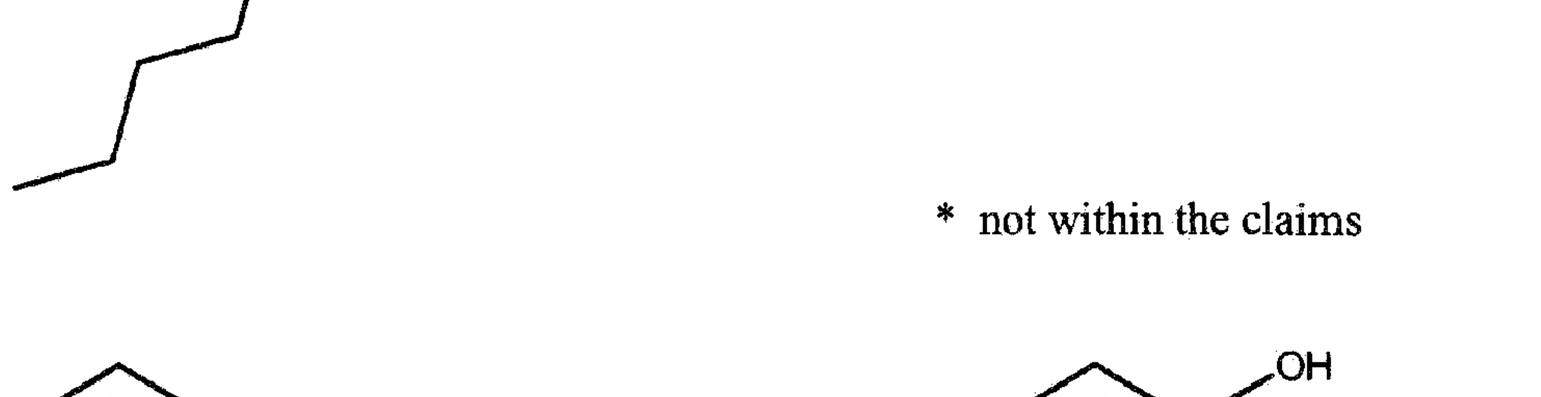
(17), *

* not within the claims



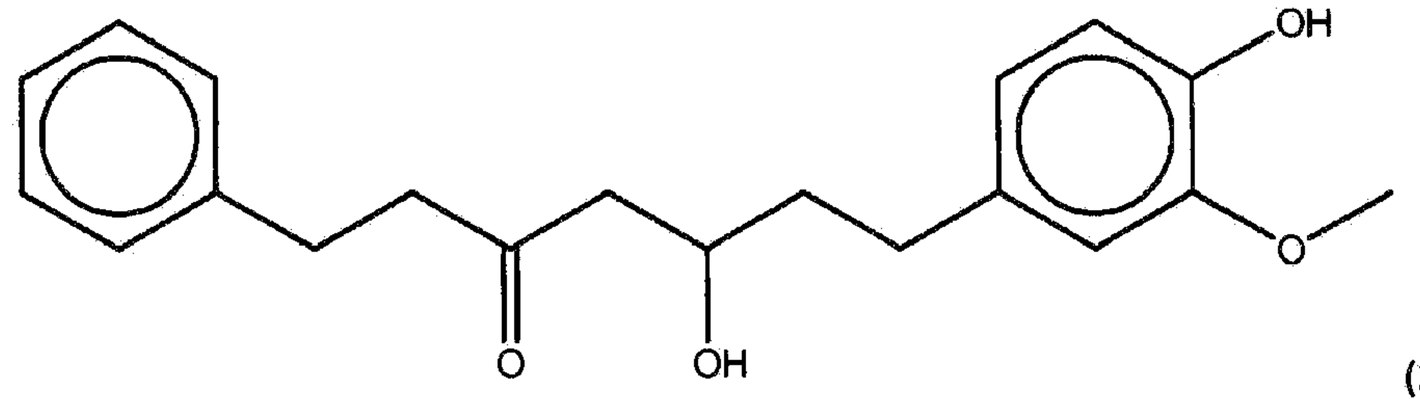
(18), *

* not within the claims



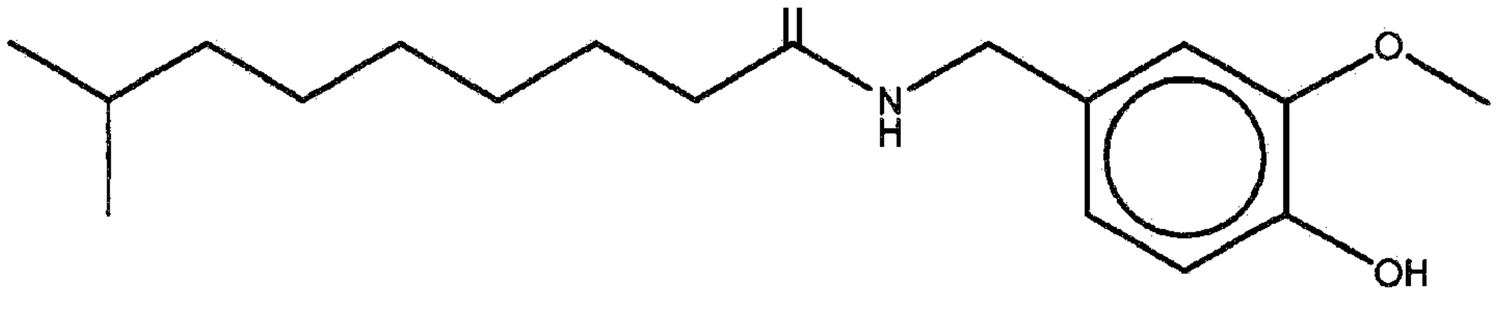
(19), *

* not within the claims



(20), *

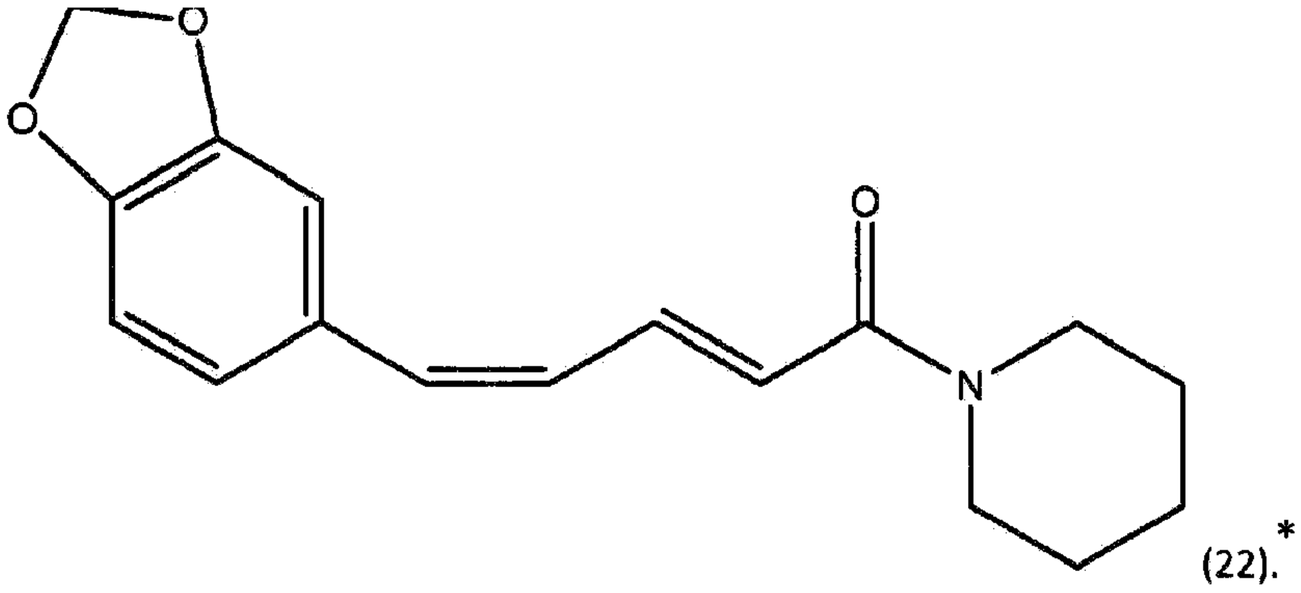
* not within the claims



(21),*

* not within the claims

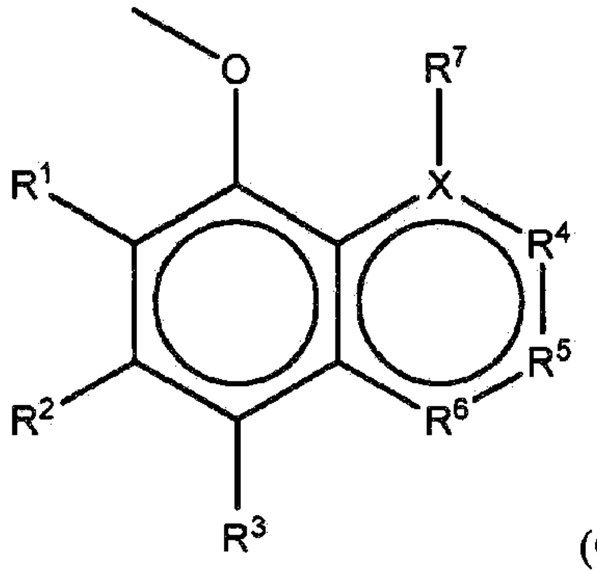
or



(22).*

* not within the claims

[0034] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (which is not within the claims):



(C),

where:

X = C or N;

R^1 and R^2 are each independently selected from H, OH, C_1-C_3 alkoxy, straight or branched chain, saturated or unsaturated C_1-C_6 alkyl or alkenyl, or R^1 and R^2 together with the carbons to which they are bound form a part of a five or six membered ring structure;

R^3 is H, OH, C_1-C_3 alkoxy, or C_1-C_6 alkyl;

R^4 and R^5 are each independently selected from CH, C=O, C-benzyl methoxy, C-R^8 or C-C(O)R^8 where R^8 is straight or branched chain, saturated or unsaturated C_1-C_6 alkyl, or R^4 and R^5 together are part of an aromatic six-membered ring structure sharing a side with the

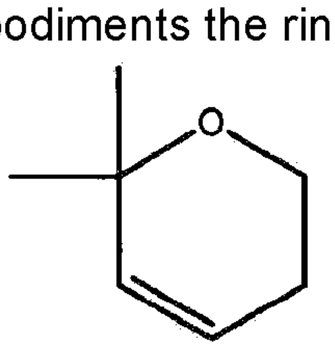
remainder of the structure of Formula C;

R^6 is selected from O, CH, C=O, or C-O-R^8 where R^8 is H or C_1-C_3 alkyl; and

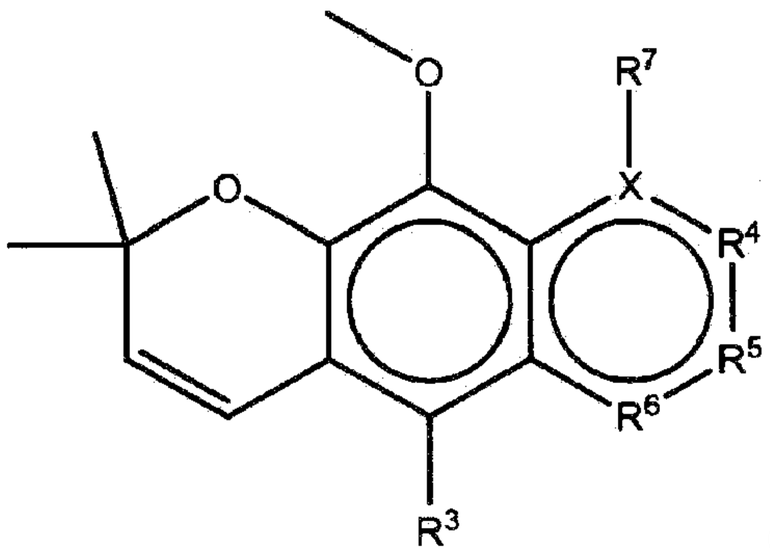
R^7 is H, OH, C_1-C_3 alkoxy, or C_1-C_3 alkyl.

[0035] In embodiments, when X is N, R^7 is methyl. In embodiments, when X is N, R^6 is C=O or C-OR^8, such as C-O-Me. In embodiments when X is C, R^7 is H or OH. In embodiments when X is C, R^6 is O. In embodiments, R^3 is H or methoxy. In embodiments, one of R^4 or R^5 is C=O and the other is H, C-benzyl methoxy, C-$CH_2CHC(CH_3)_2$ or C-C(O)$CHC(CH_3)_2$.

[0036] In embodiments, R^1 and R^2 together with the carbons to which they are bound form a part of a six membered ring structure. In embodiments, the six membered ring structure includes an oxygen or nitrogen heteroatom. In embodiments, the six membered ring structure contains one or more carbon atoms substituted with one or more C_1-C_6 alkyl, such as methyl. In embodiments, one carbon atom of the ring structure is substituted with two methyl groups. In embodiments, the ring structure is an unsubstituted six carbon aromatic ring structure. In embodiments the ring has the following structure:

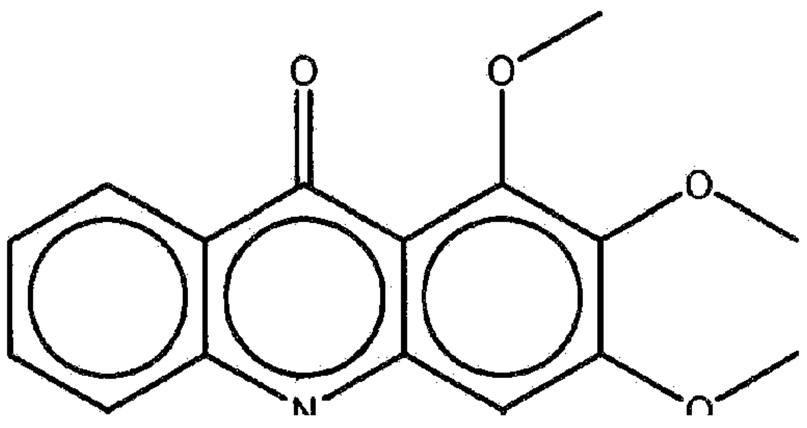


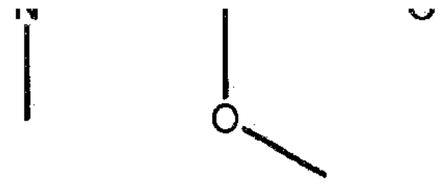
to form a structure of the following formula



(C').

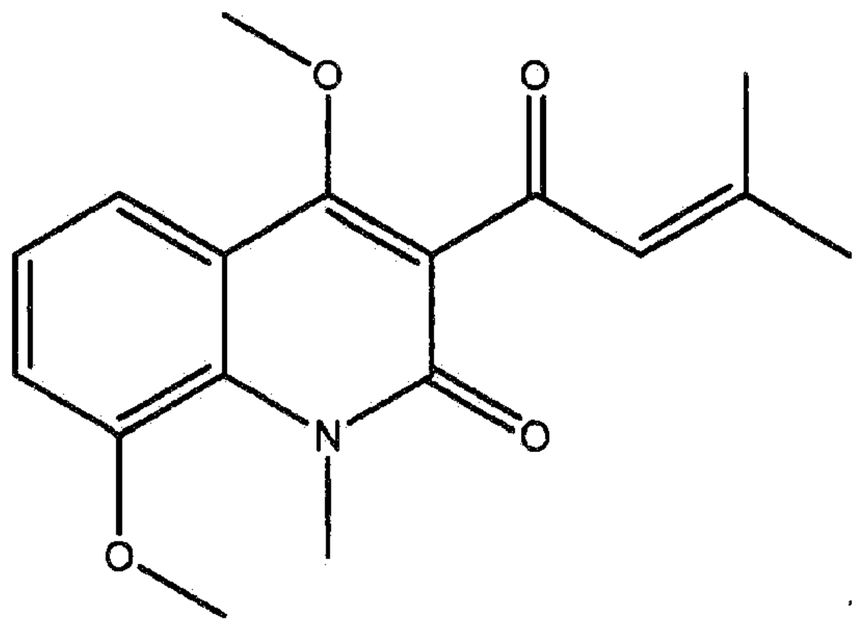
[0037] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:





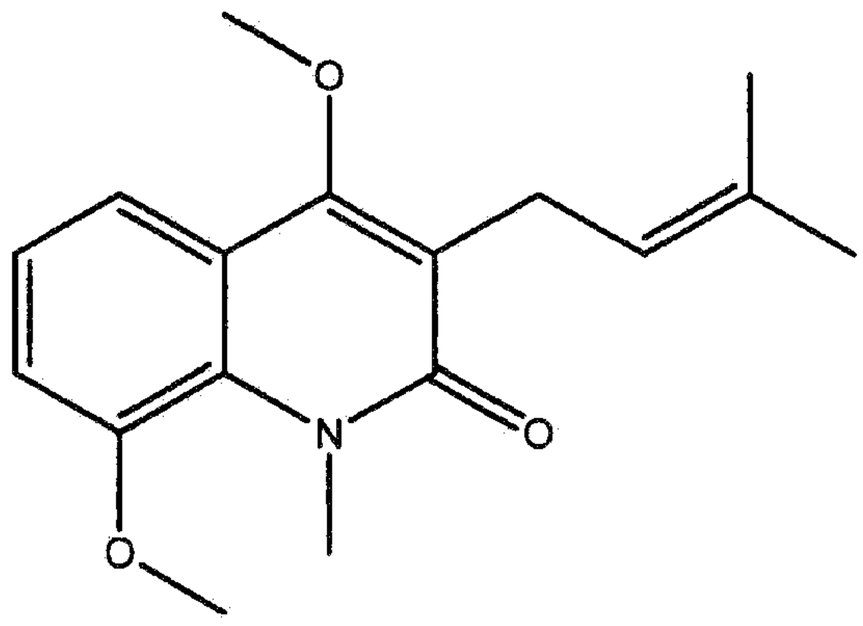
(23), *

* not within the claims



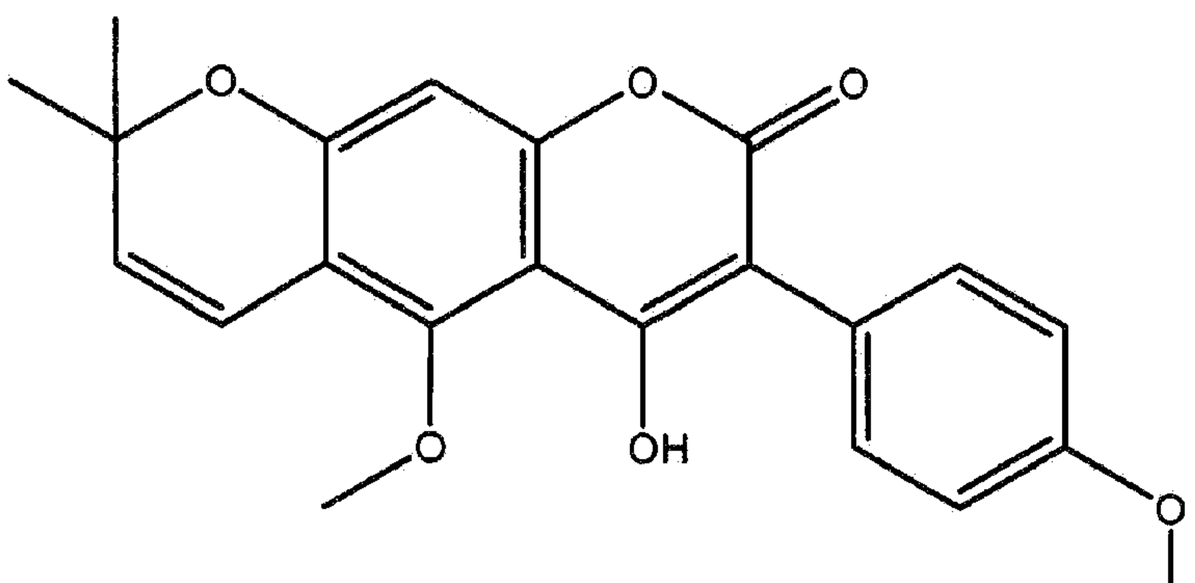
(24) *

* not within the claims



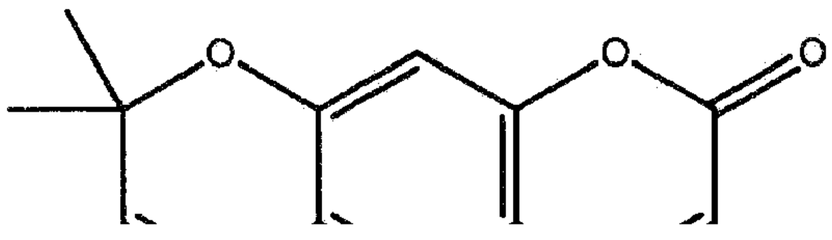
(25) *

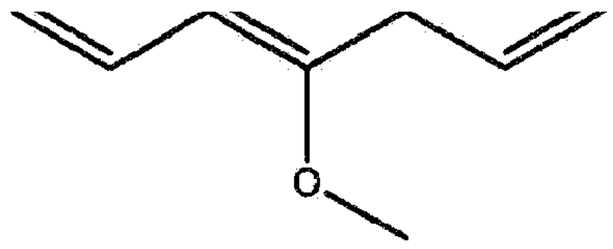
* not within the claims



(26), *

* not within the claims

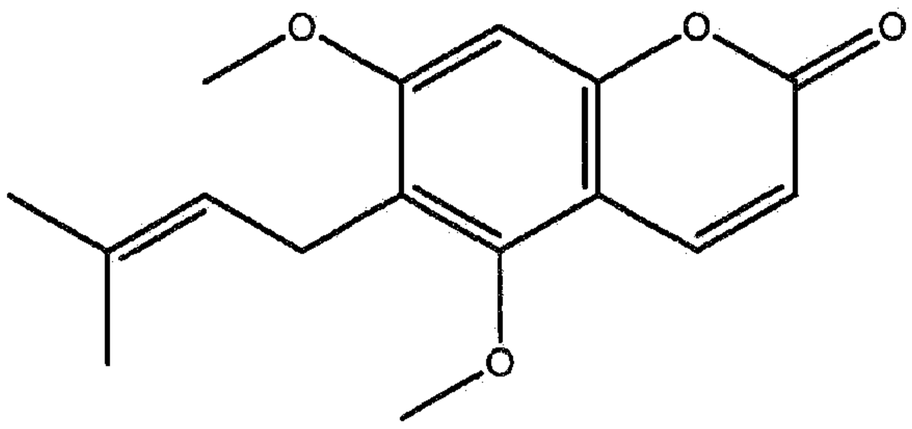




(27),*

* not within the claims

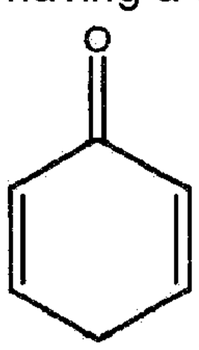
or



(28).*

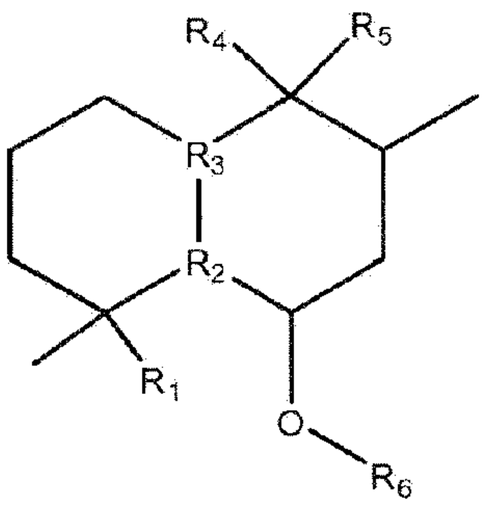
* not within the claims

[0038] For the purposes of the present disclosure, it will be understood that a ring structure having a structure of



, or the like, will be considered to be aromatic.

[0039] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:



(D),

where:

R^1 is H, methyl, $OCOCH_3$ or forms together with R^6 a five membered ring structure in which R^1 and R^6 together are C=O or CH_2;

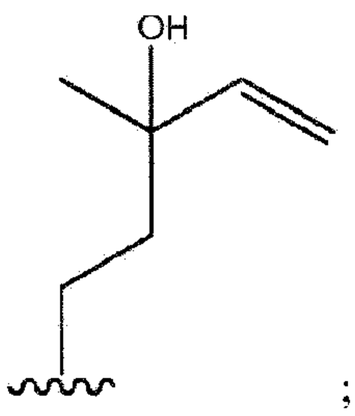
R^6 is H, $C{=}OCH_3$, or together forms a five membered ring structure in which R^1 and R^6 together are C=O or CH_2;

R^2 and R^3 are CH or C, wherein when R^2 and R^3 are C a double bond is formed between R^2

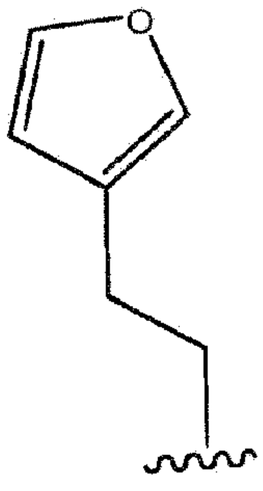
and R^3;

R^4 and R^5 are independently selected from OH, methyl;

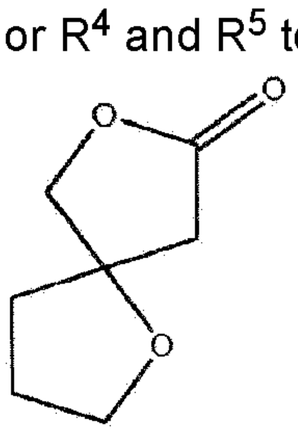
R^4 and R^5 arc independently selected from OH, methyl;



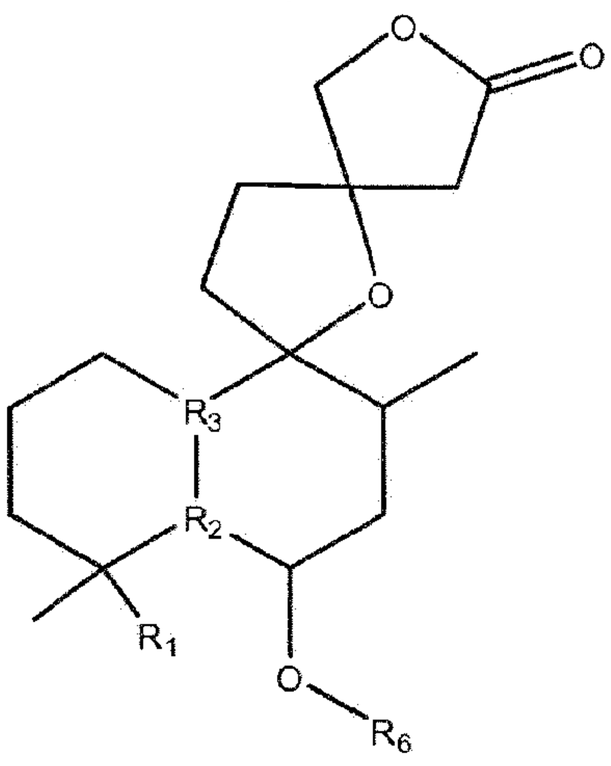
;



or R^4 and R^5 together with the carbon to which they are bound form



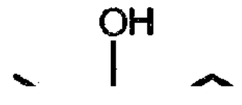
to form a compound of the following formula

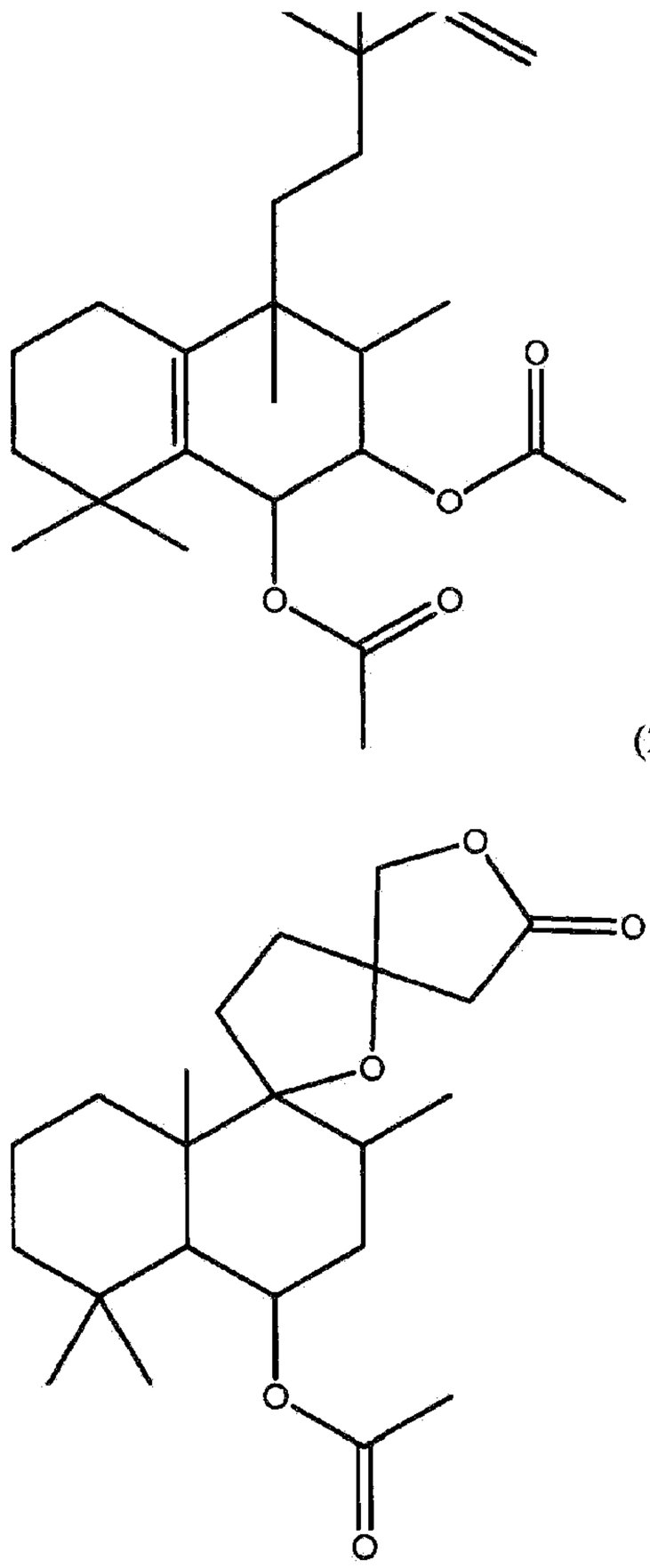


(D').

Compound (29) falls within structure (D) and falls within the claims.

[0040] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:



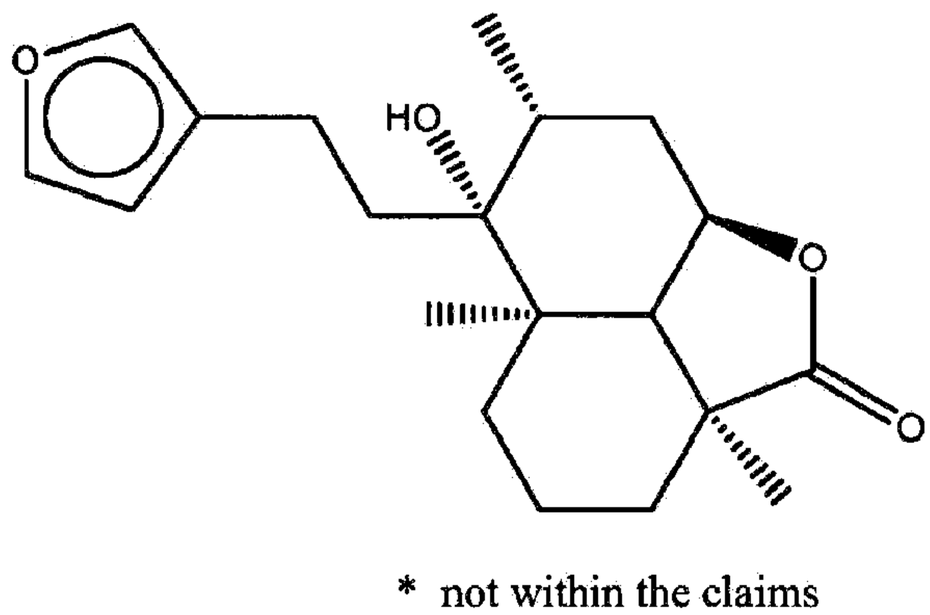


(29),

(30),*

* not within the claims

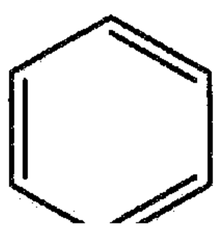
or

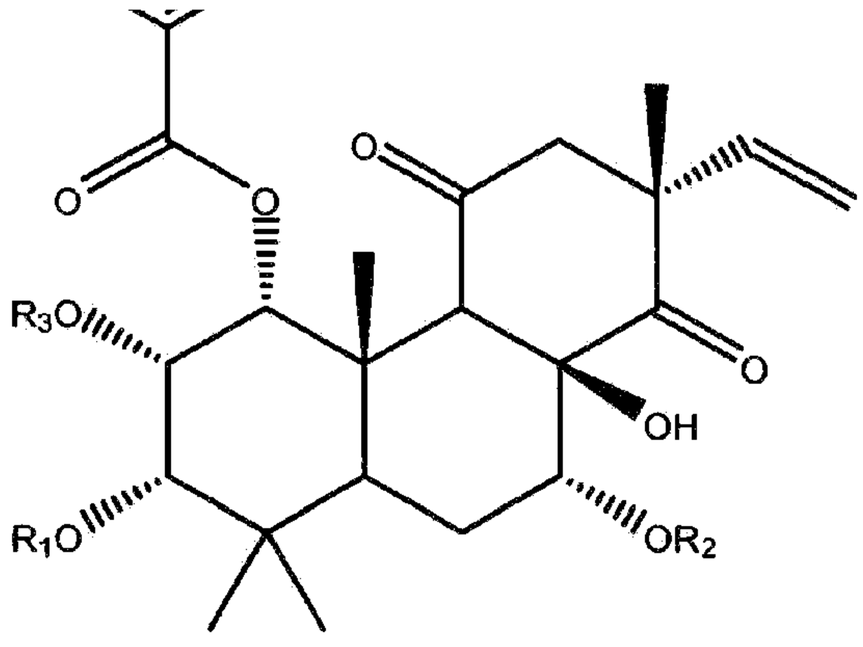


(31).*

* not within the claims

[0041] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:

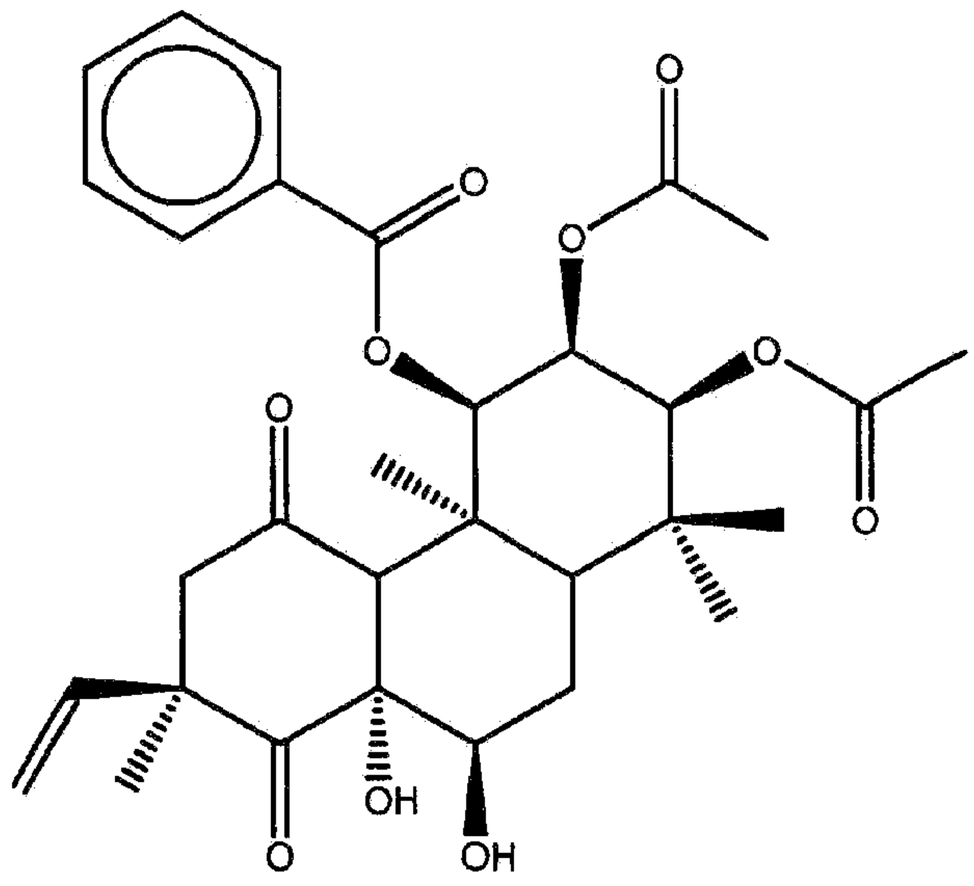




(E)

where R1, R2 and R3 are independently selected from the group consisting of H and $COCH_3$. Compound (33) falls within structure (E) and falls within the claims.

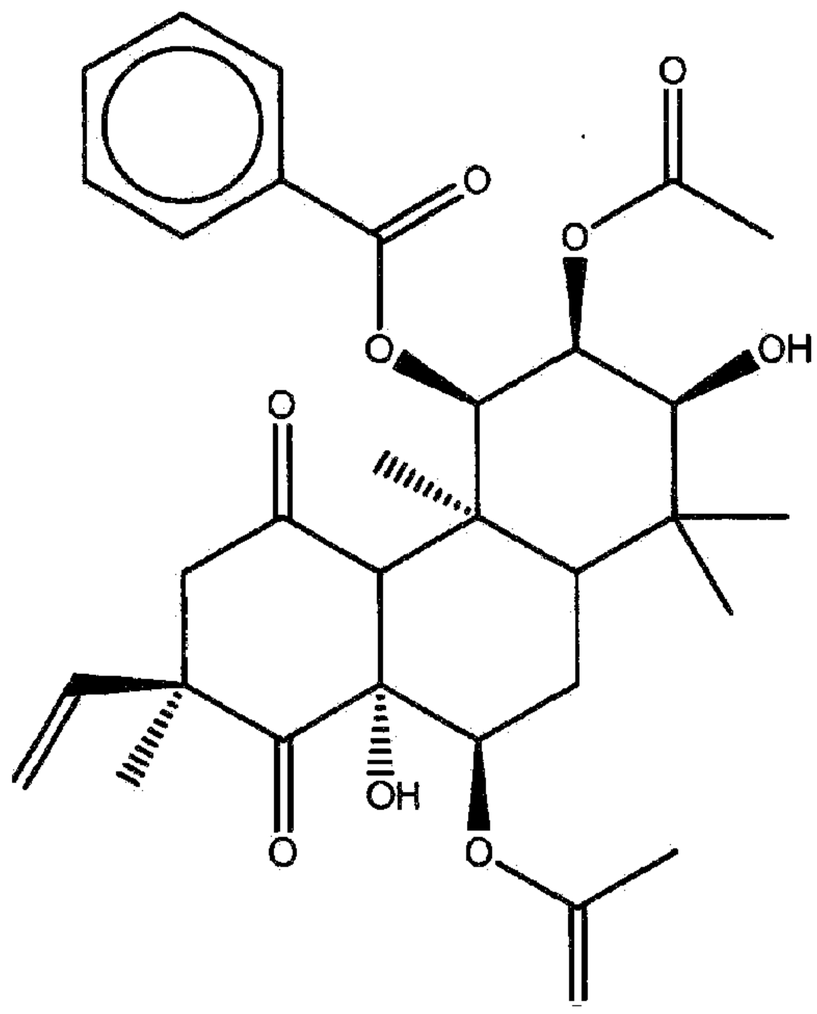
[0042] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:

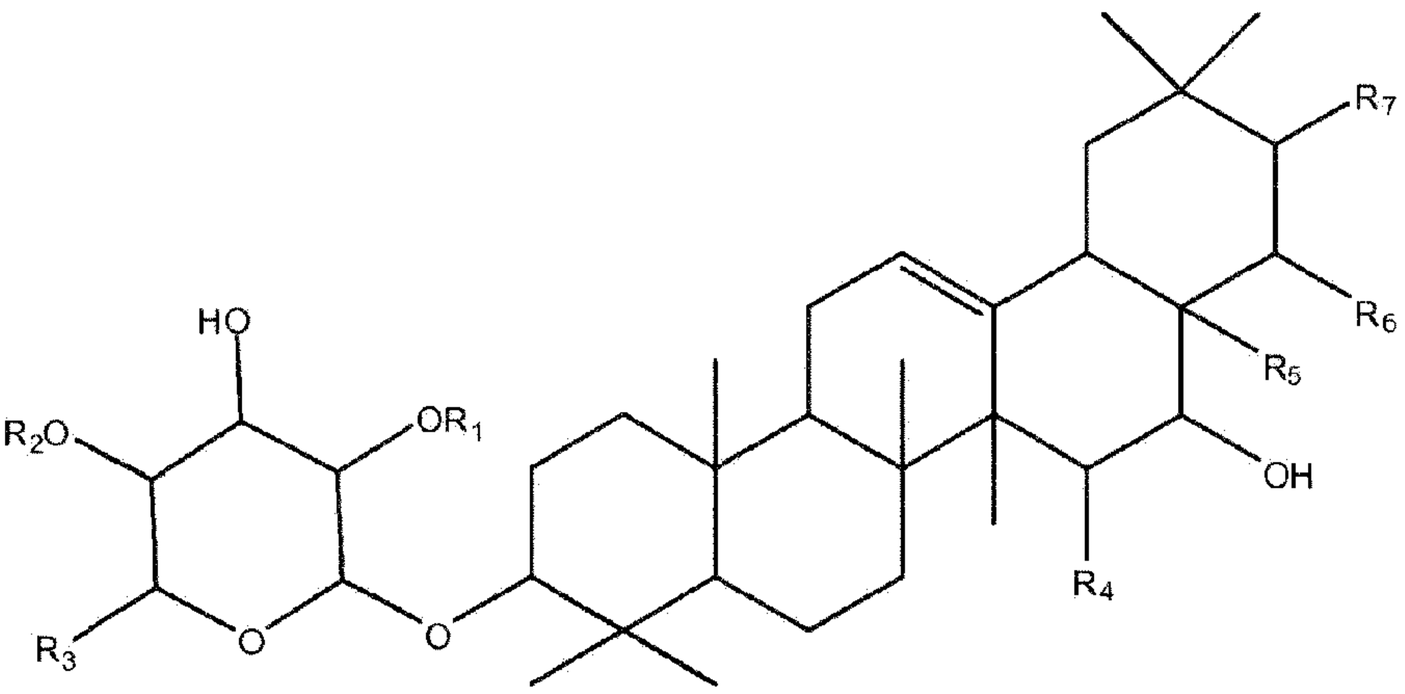


(32),*

* not within the claims

or





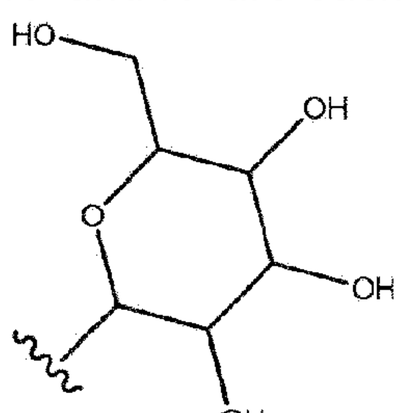
(33).

[0043] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:

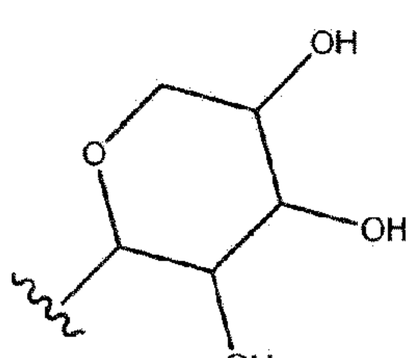
(F1),

where:

R^1 and R^2 are each independently H,

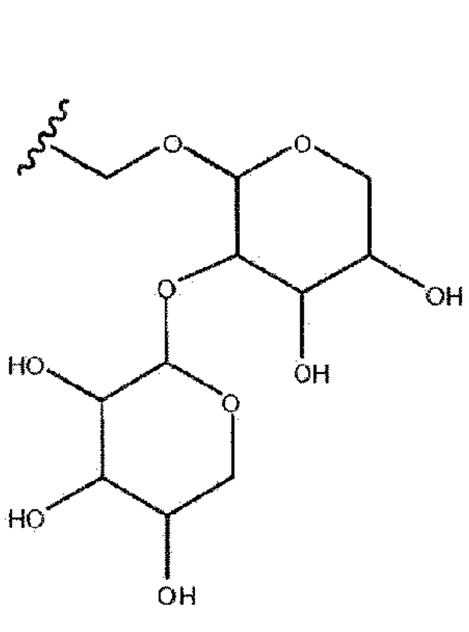


, or

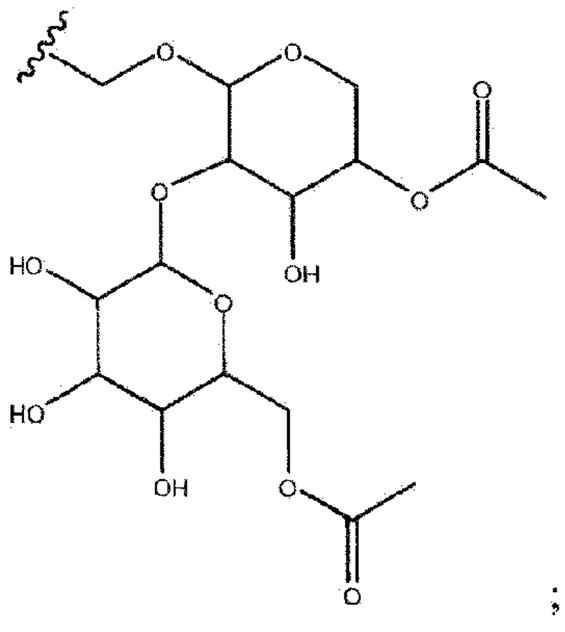


;

R^3 is CH_2OH, COOH,



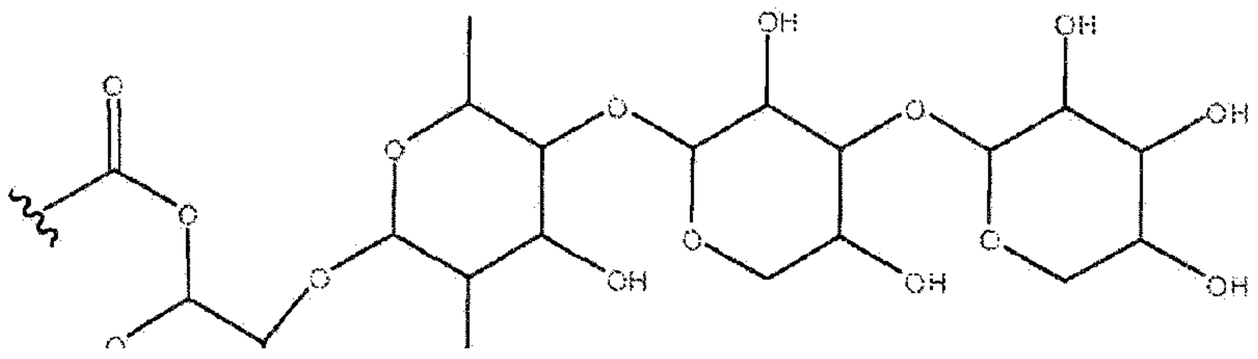
, or

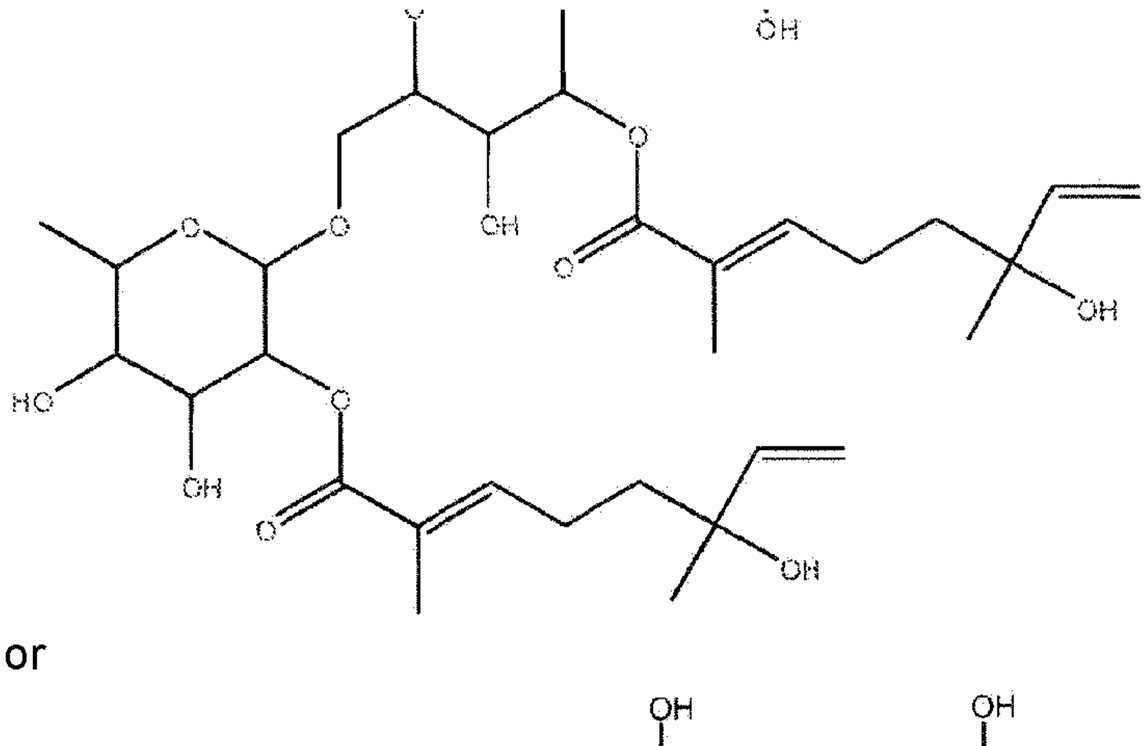


;

R^4 is H or OH;

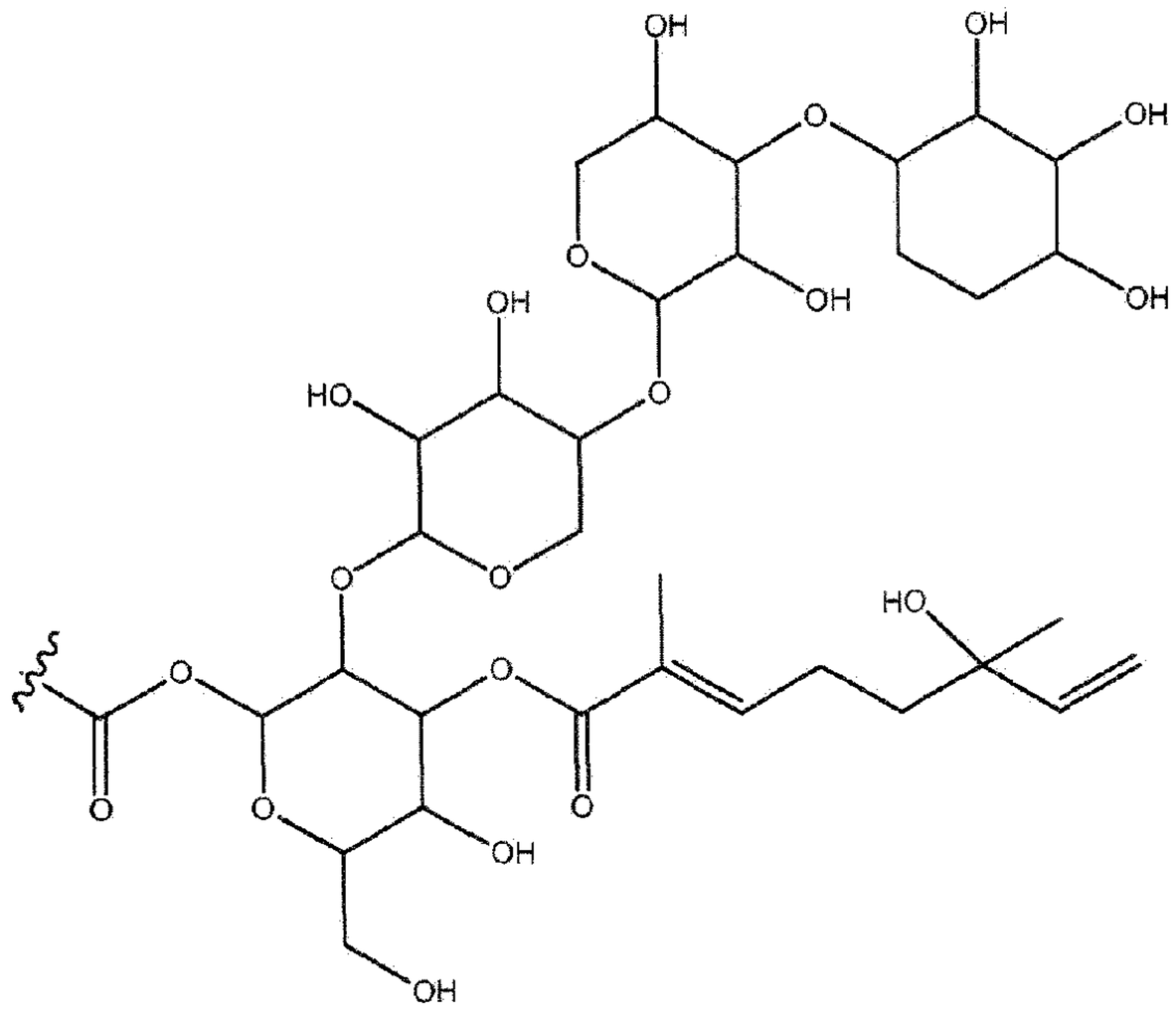
R^5 is CH_2OH,





,

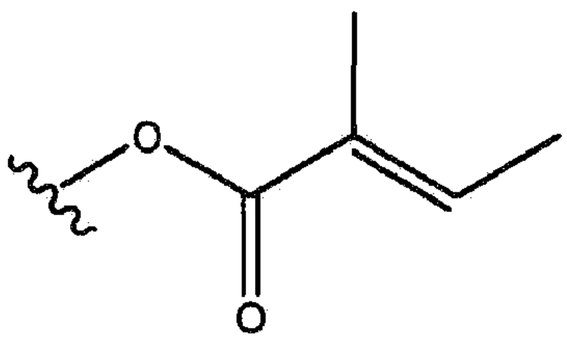
or



;

R^6 is H or OH; and

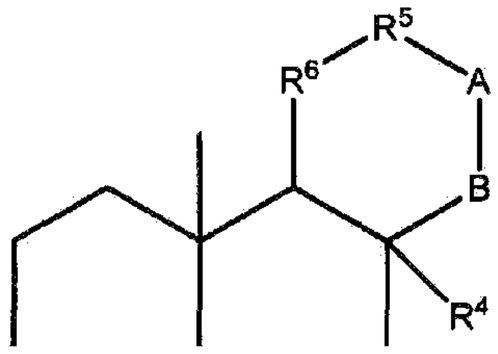
R^7 is H or

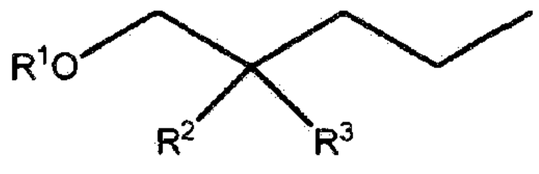


.

Compounds (36) and (37) fall within structure (F) and fall within the claims.

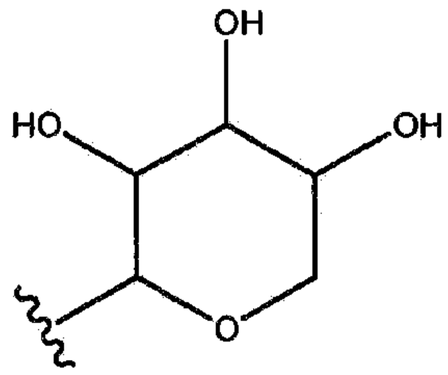
[0044] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:



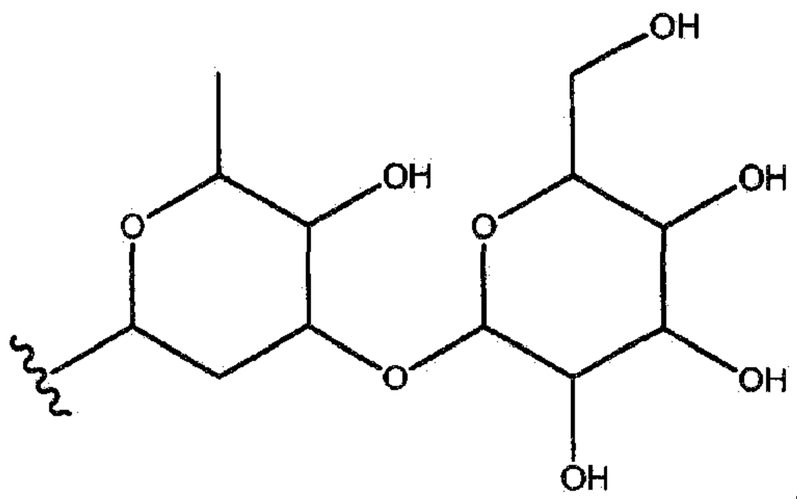


(F2),

where R^1 is

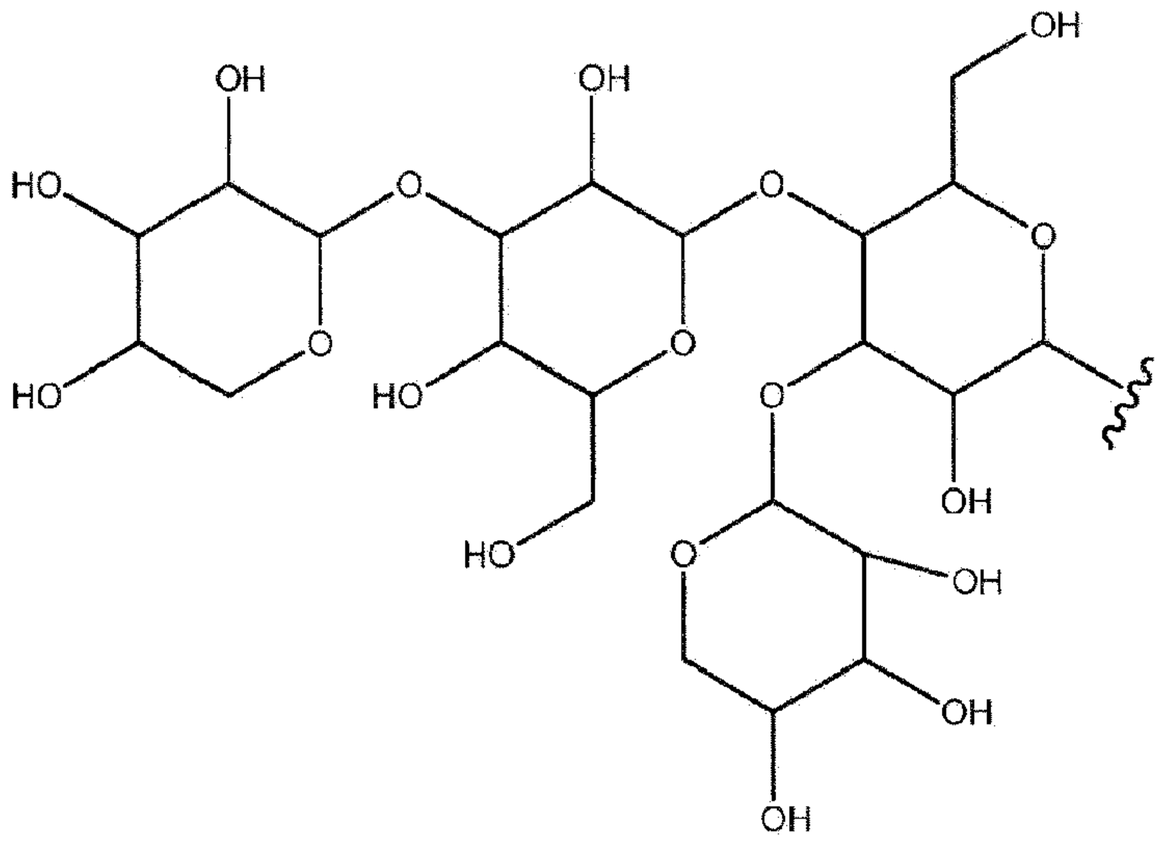


,



,

or



;

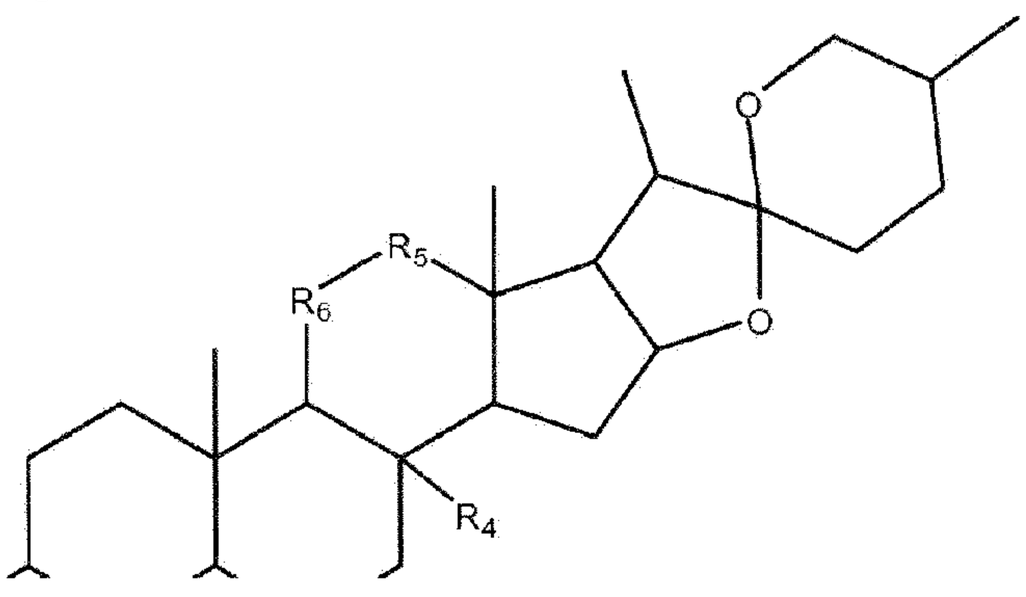
R^2 and R^3 are each independently H, CH_3, or CH_2OH;

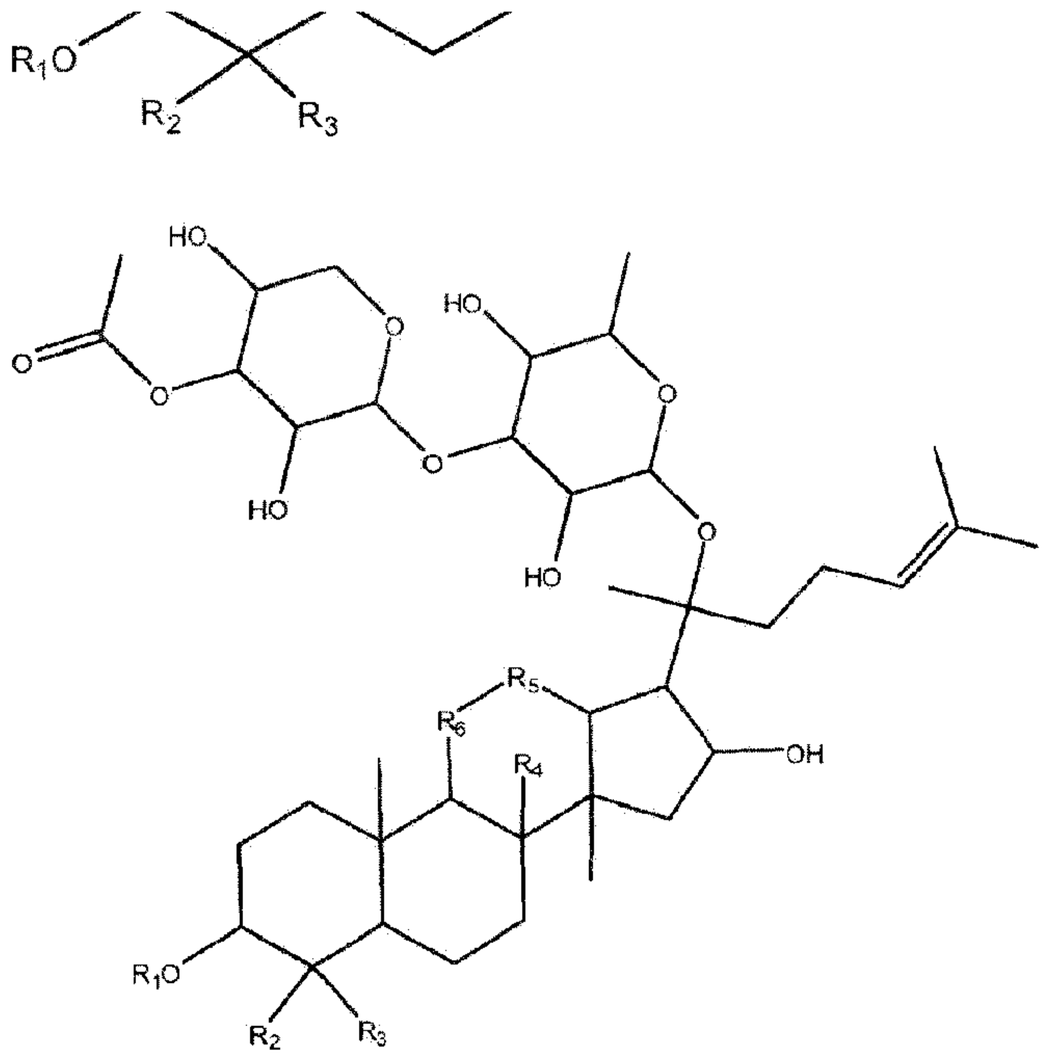
R^4 is H or CH_3;

R^5 is CH, CH_2 or C=O;

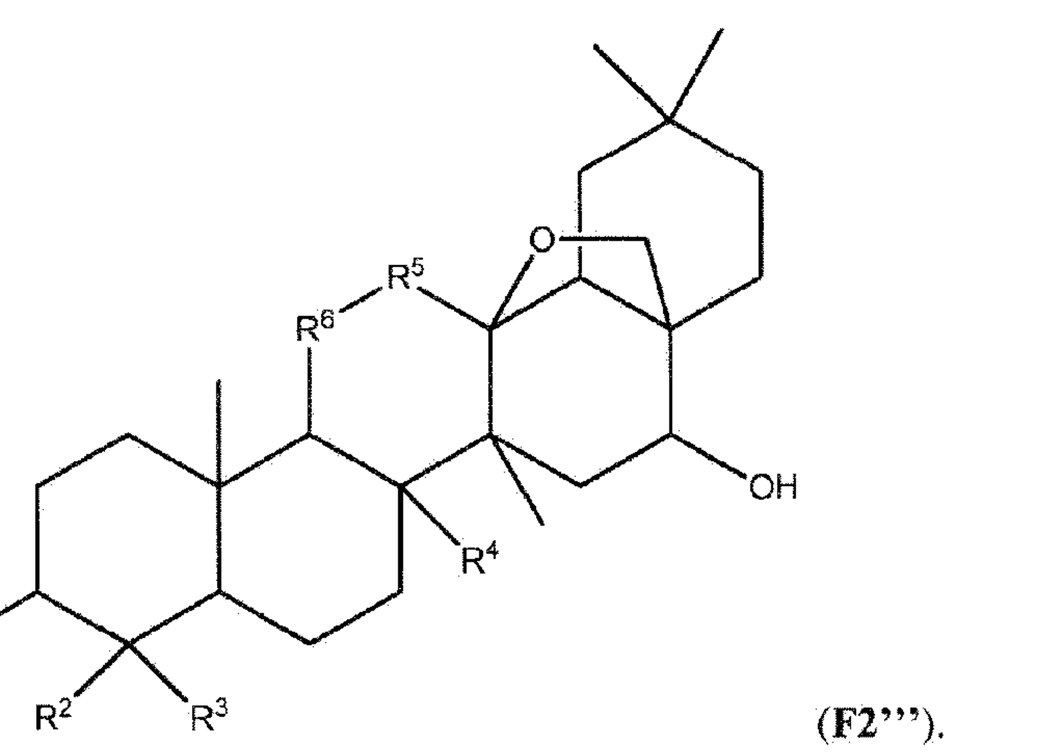
R^6 is CH or CH_2, provided that when R^5 is CH, R^6 is CH; and

A and B together form a ring structure and various substituents to form a compound having the following structure





(F2'),

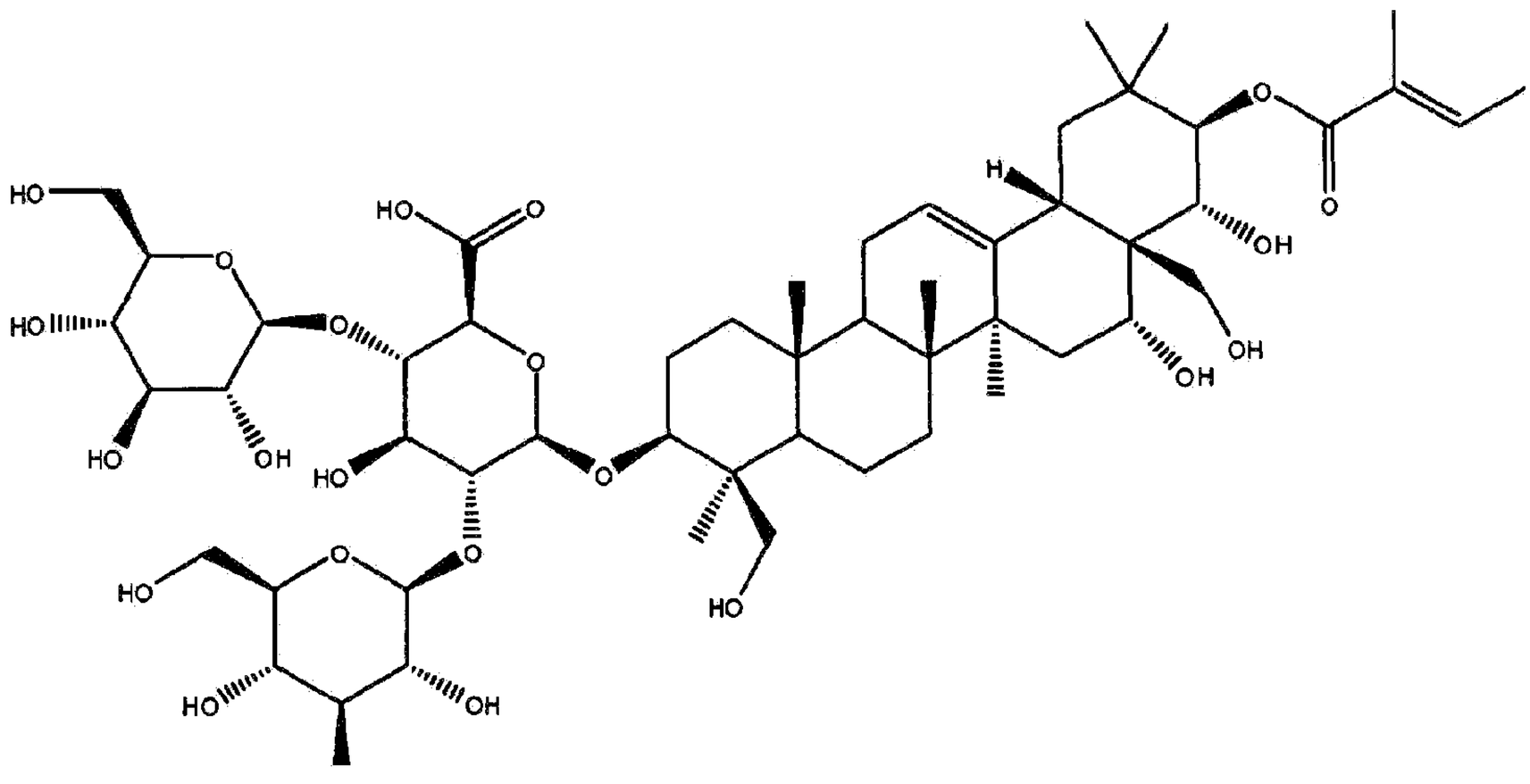


(F2''),

or

(F2''').

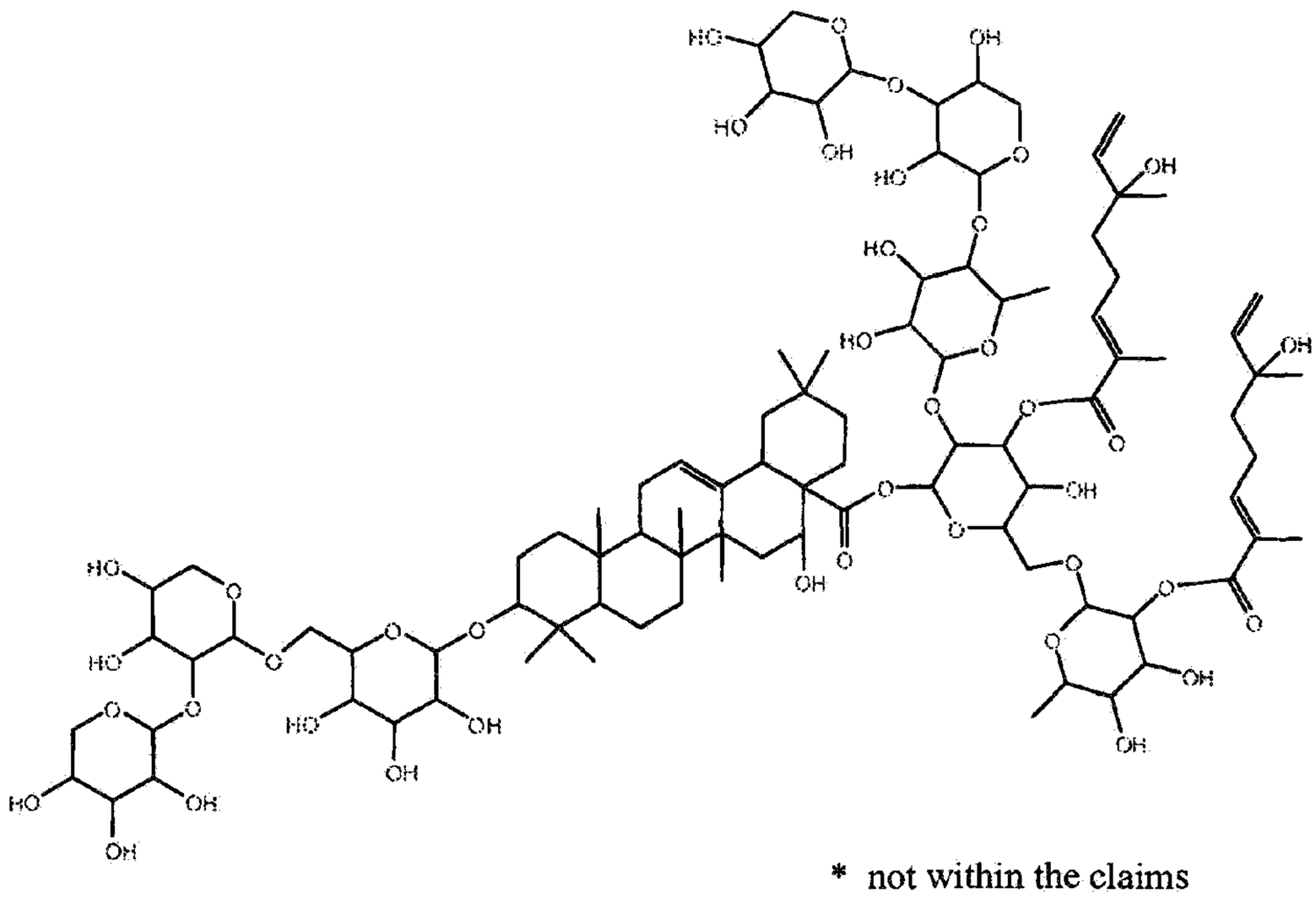
[0045] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:



OH

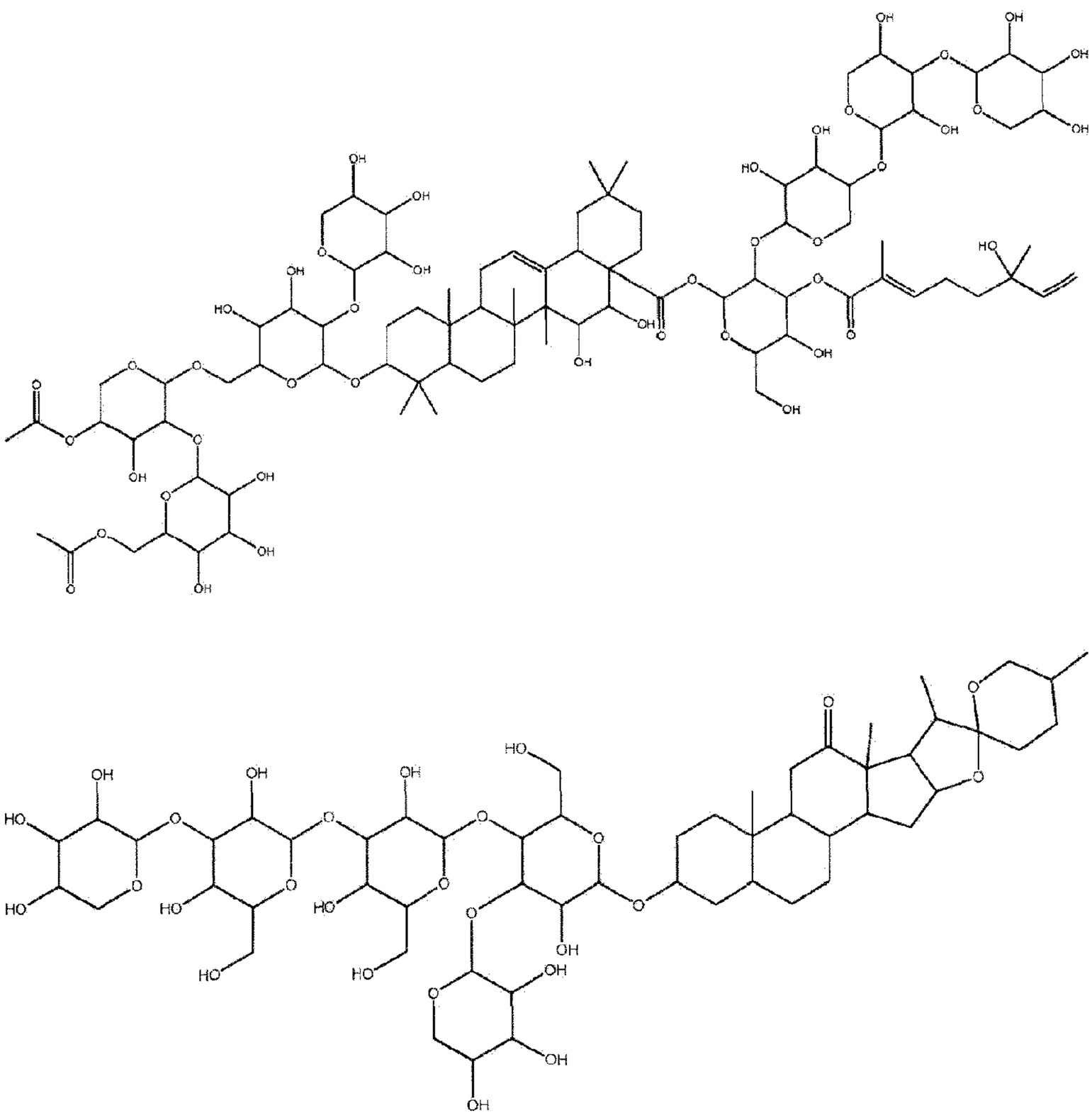
(34), *

* not within the claims



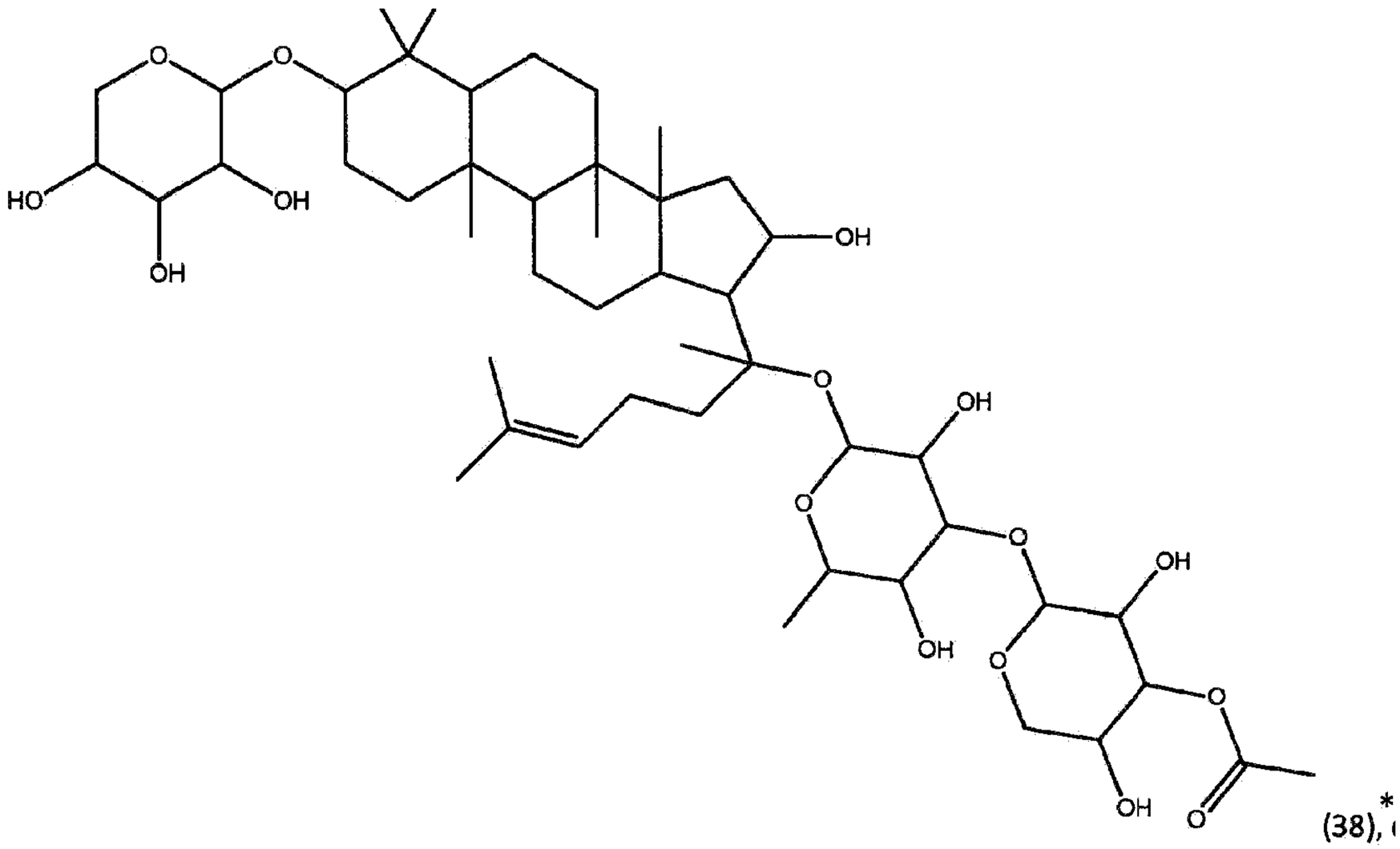
(35), *

* not within the claims



(36),

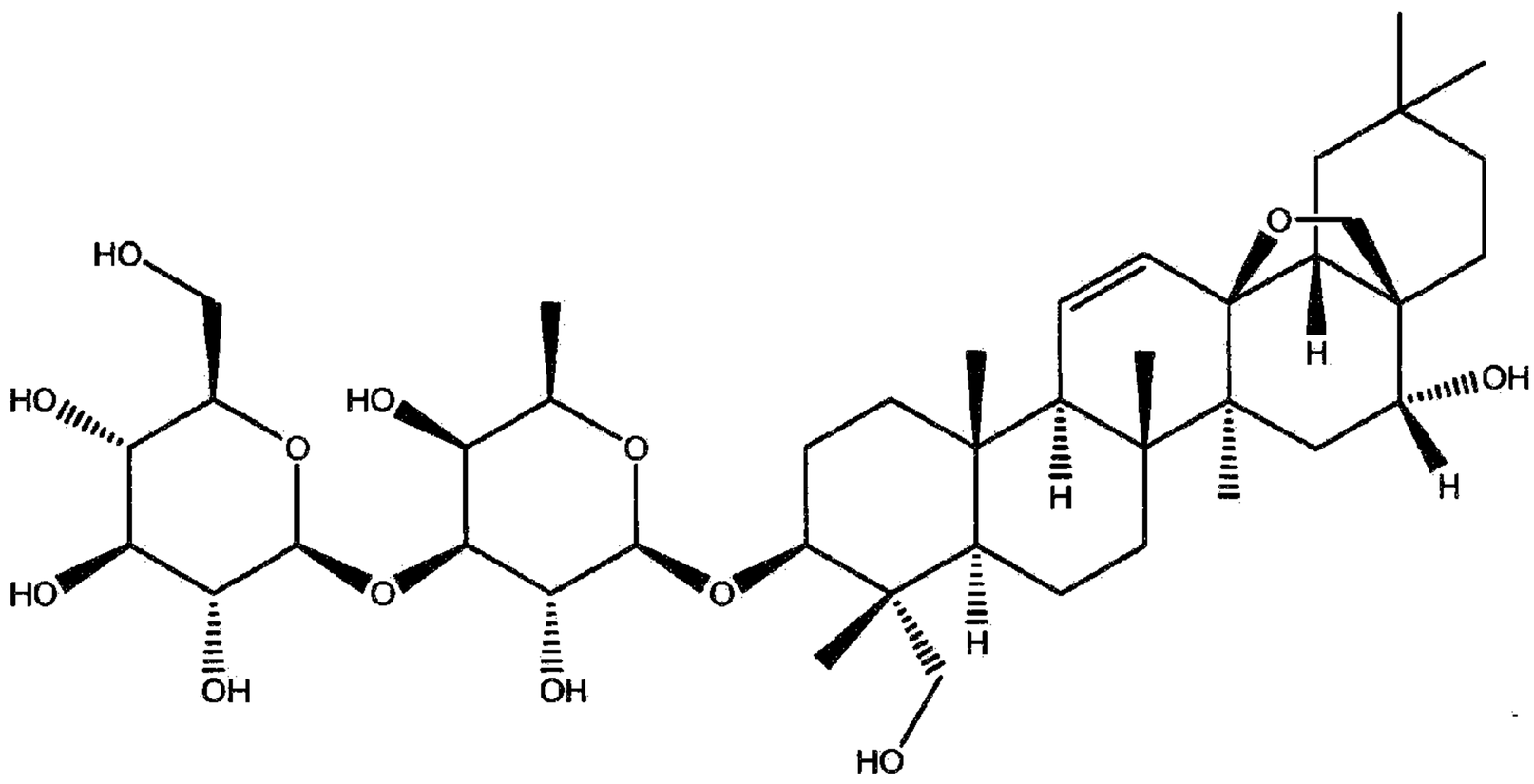
(37),



(38),*

* not within the claims

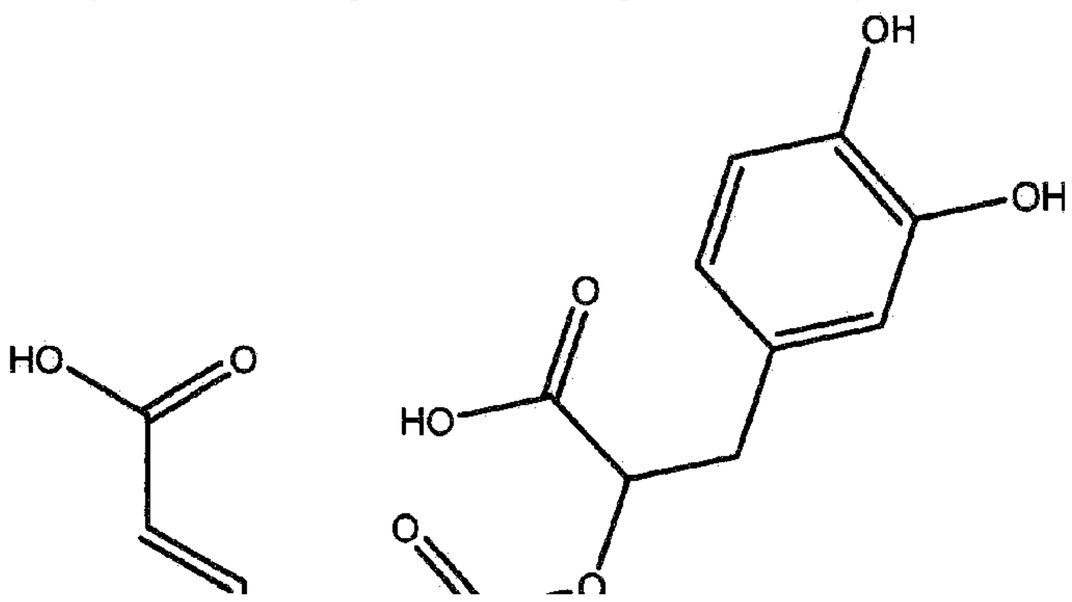
or

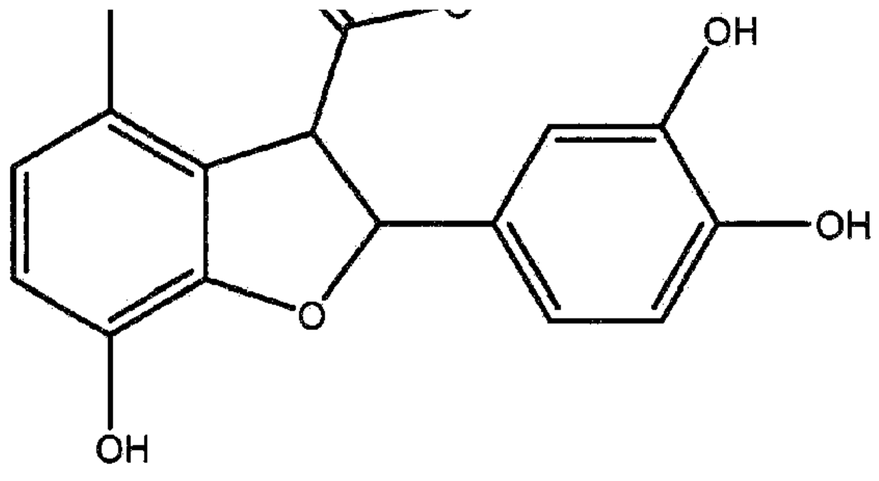


(39).*

* not within the claims

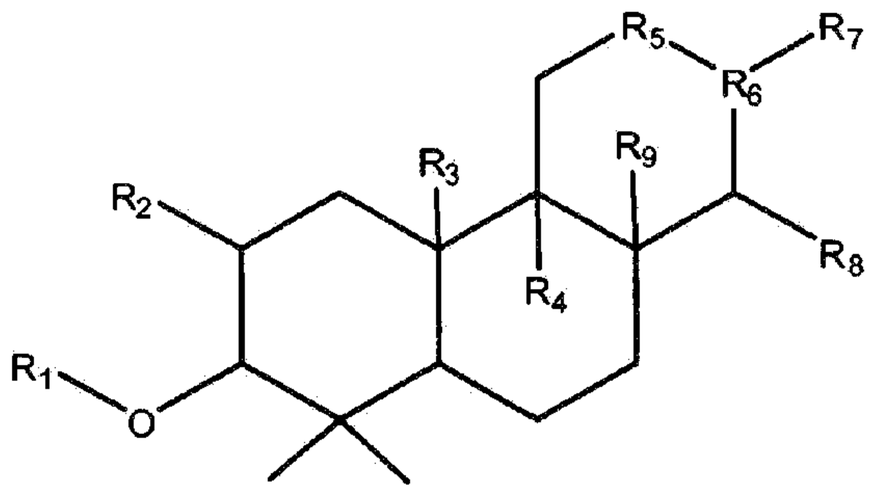
[0046] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims):





(**G**, 40).

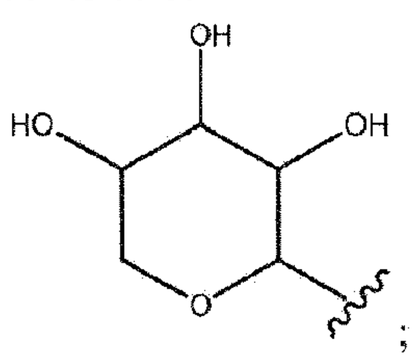
[0047] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:



(H)

where:

R^1 is H or



;

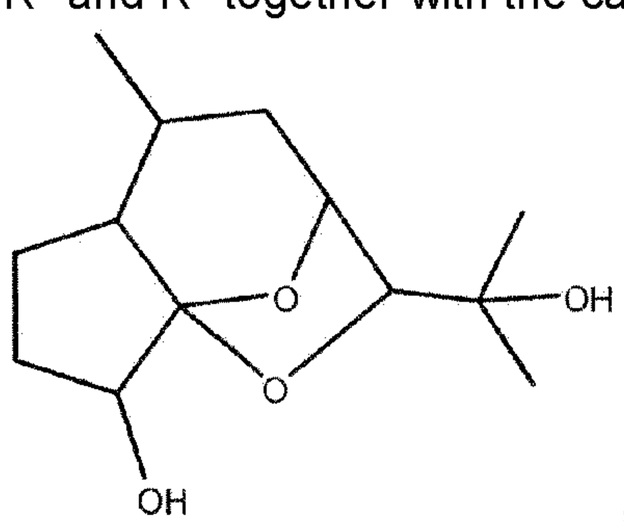
R^2 is H or OH;

R^3 and R^4 are independently selected from H or methyl or together form CH_2;

R^5 is CH_2 or CH;

R^6 is CH or C, provided that when R^5 is CH, R^6 is C;

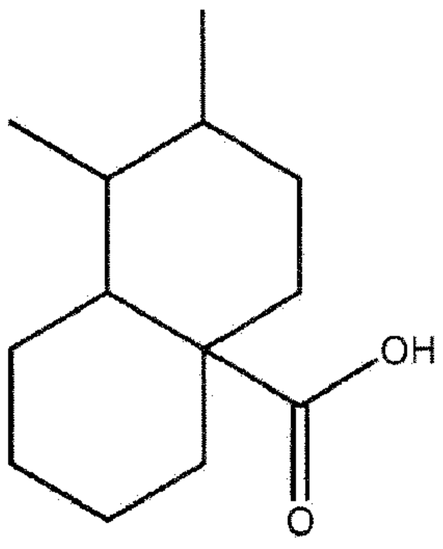
R^7 and R^8 together with the carbons to which they are bound form



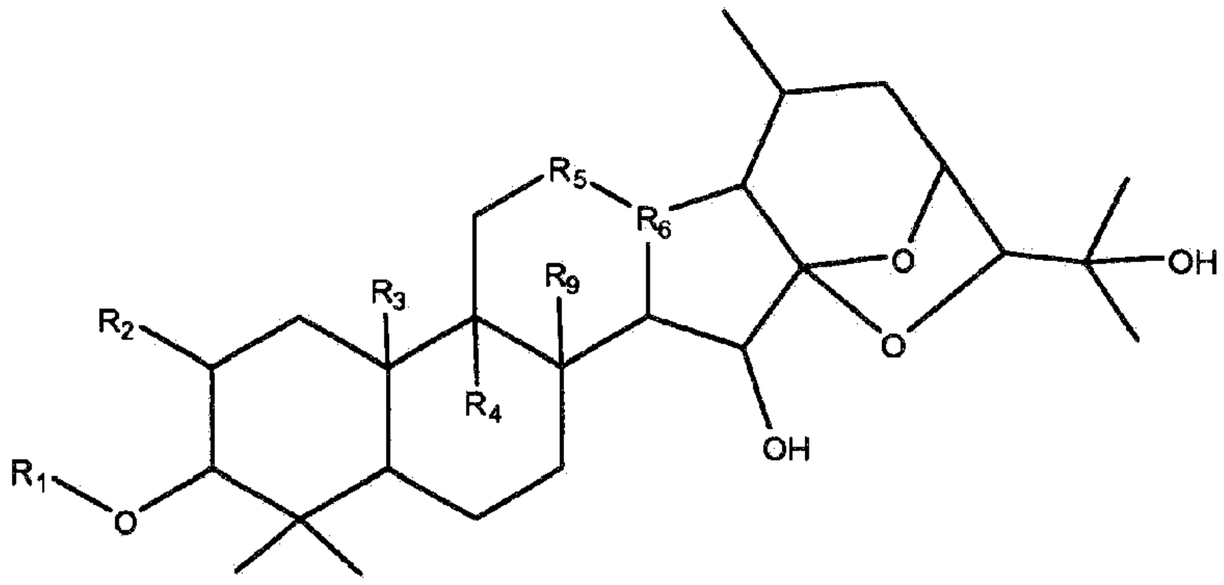
,

or

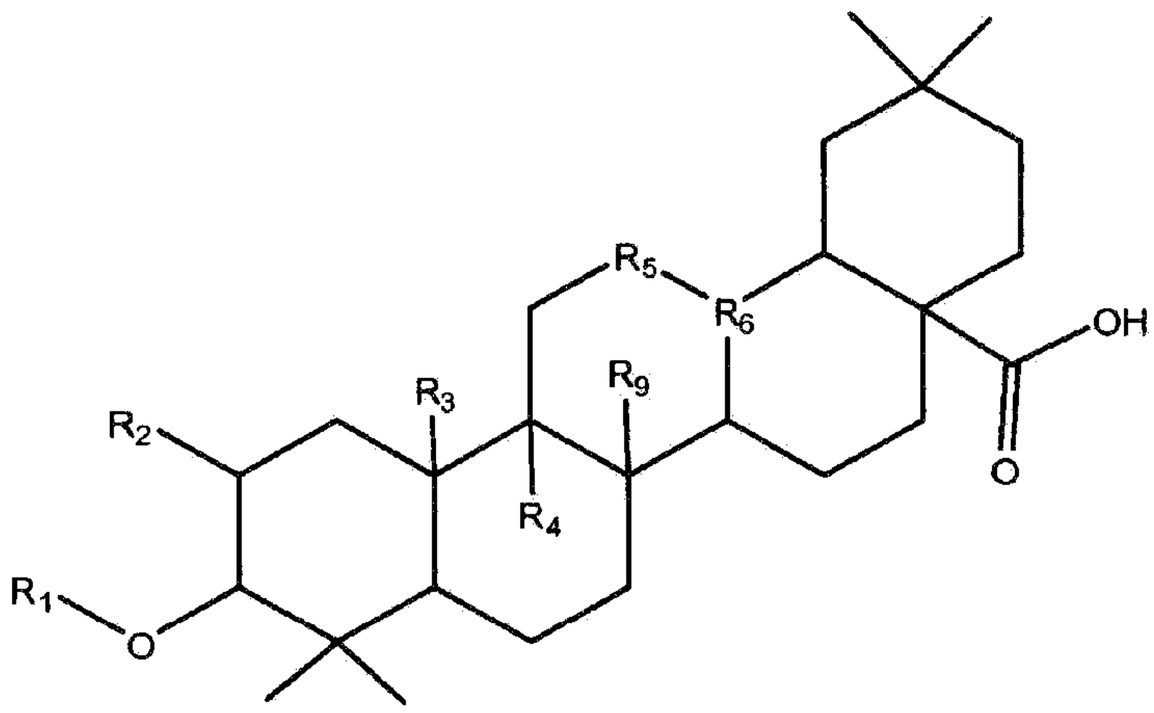
.



to form a compound having the following structure

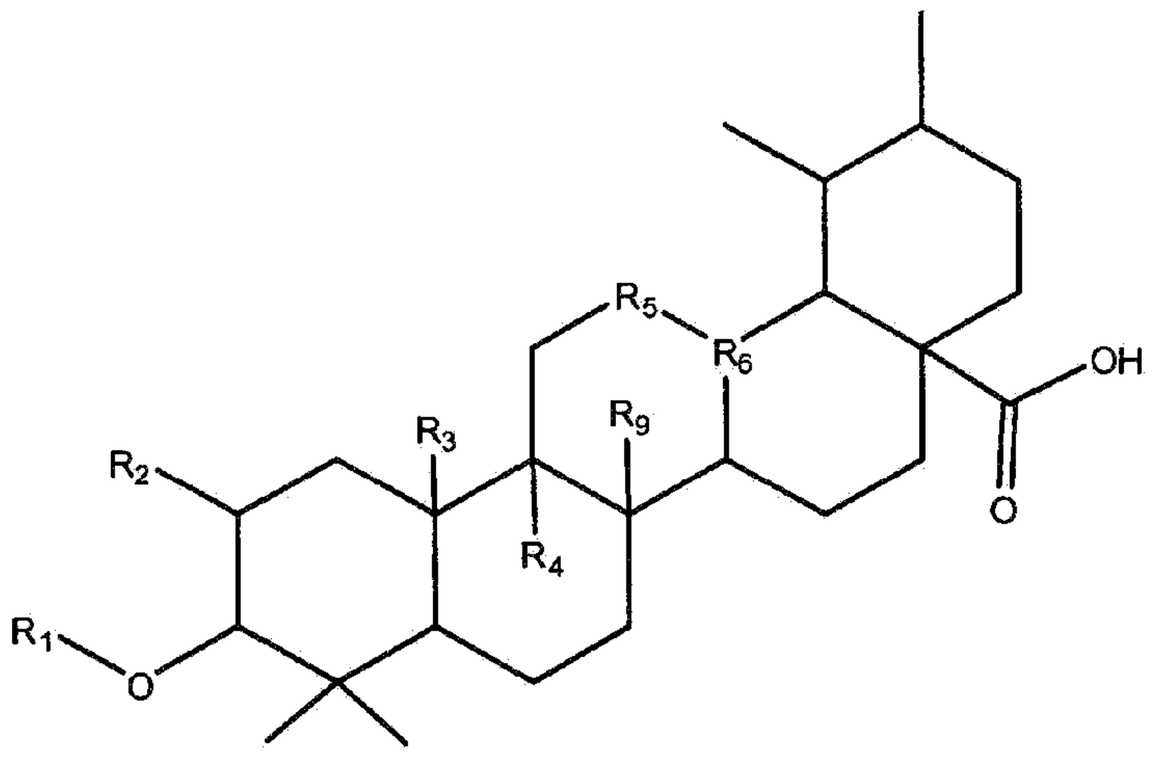


(H'),



(H'');

or



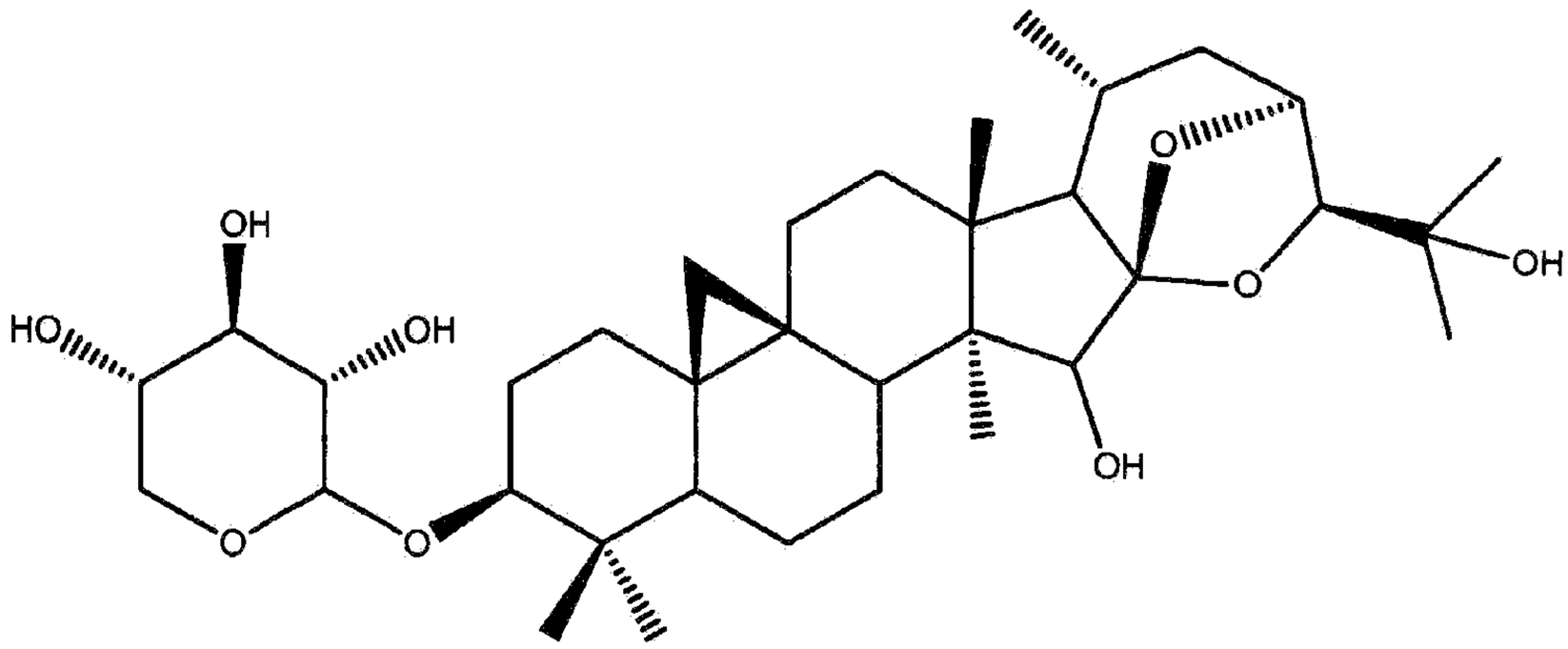
(H''');

and

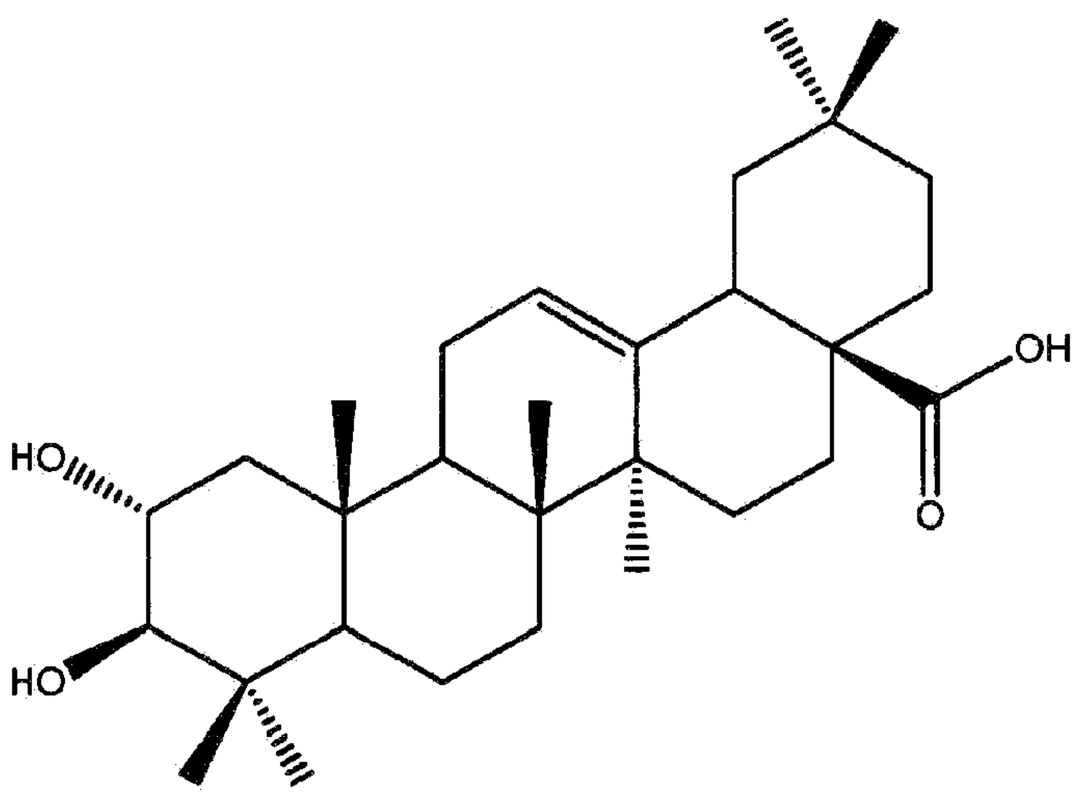
R^9 is H or methyl.

Compounds (41) and (43) fall within structure (H) and fall within the claims.

[0048] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:



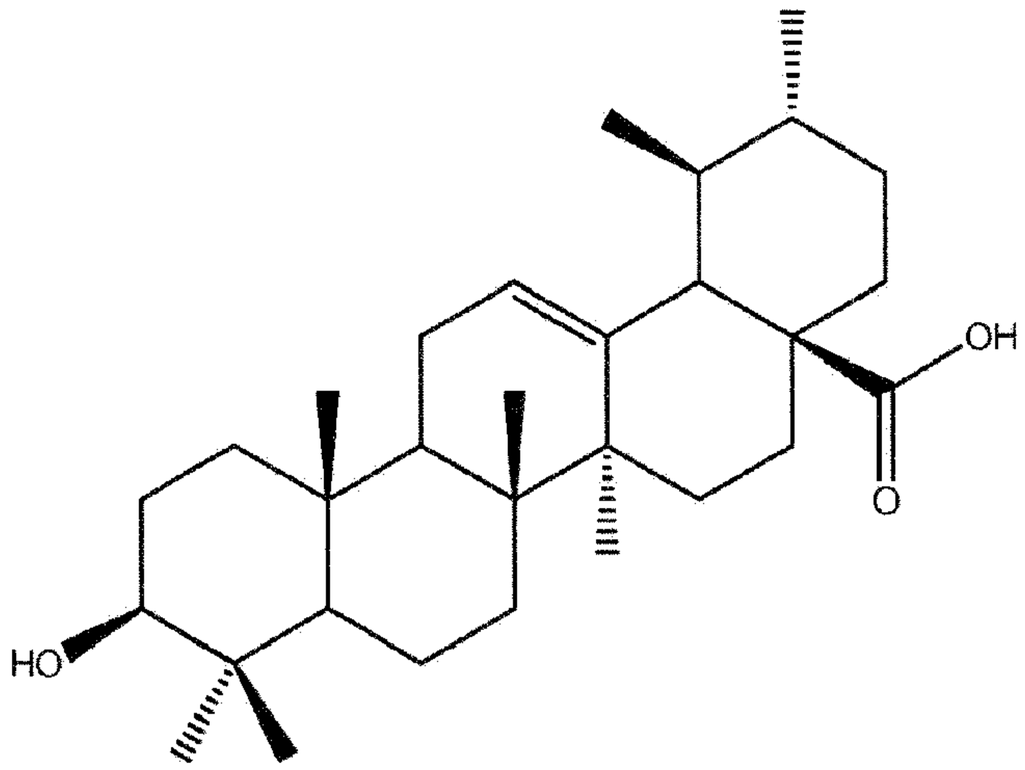
(41),



(42),*

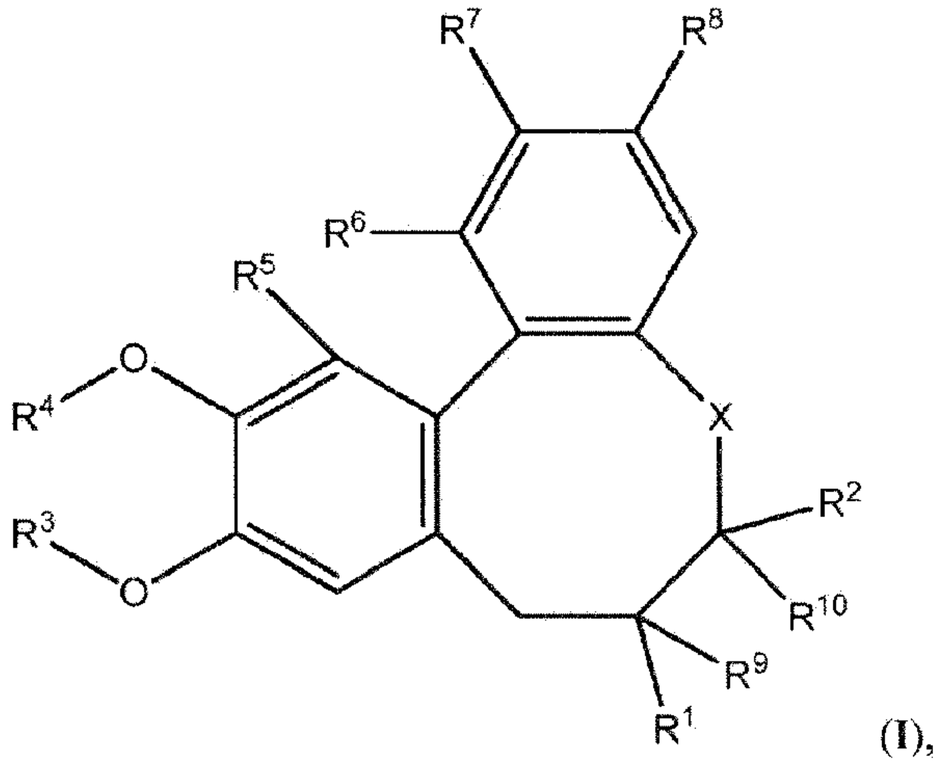
* not within the claims

or



(43).

[0049] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:



(I),

where:

X is O or CH_2;

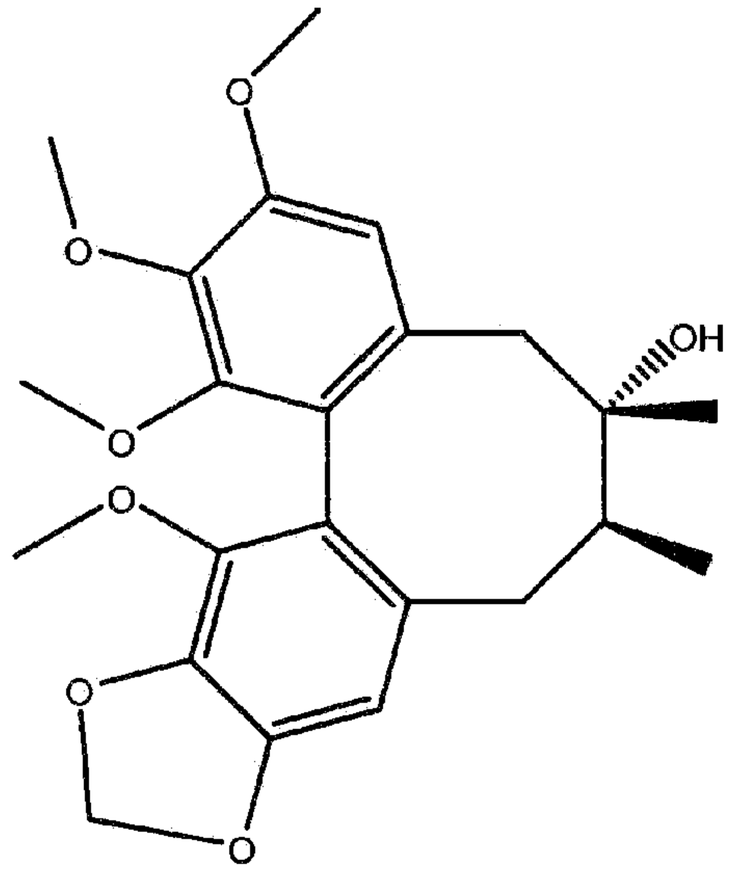
R^1 and R^9 are independently selected from H, OH, methyl, and CH_2OH;

R^2 and R^{10} are independently selected from H, OH and methyl; R^3 and R^4 are independently selected from H and methyl or together form CH_2;

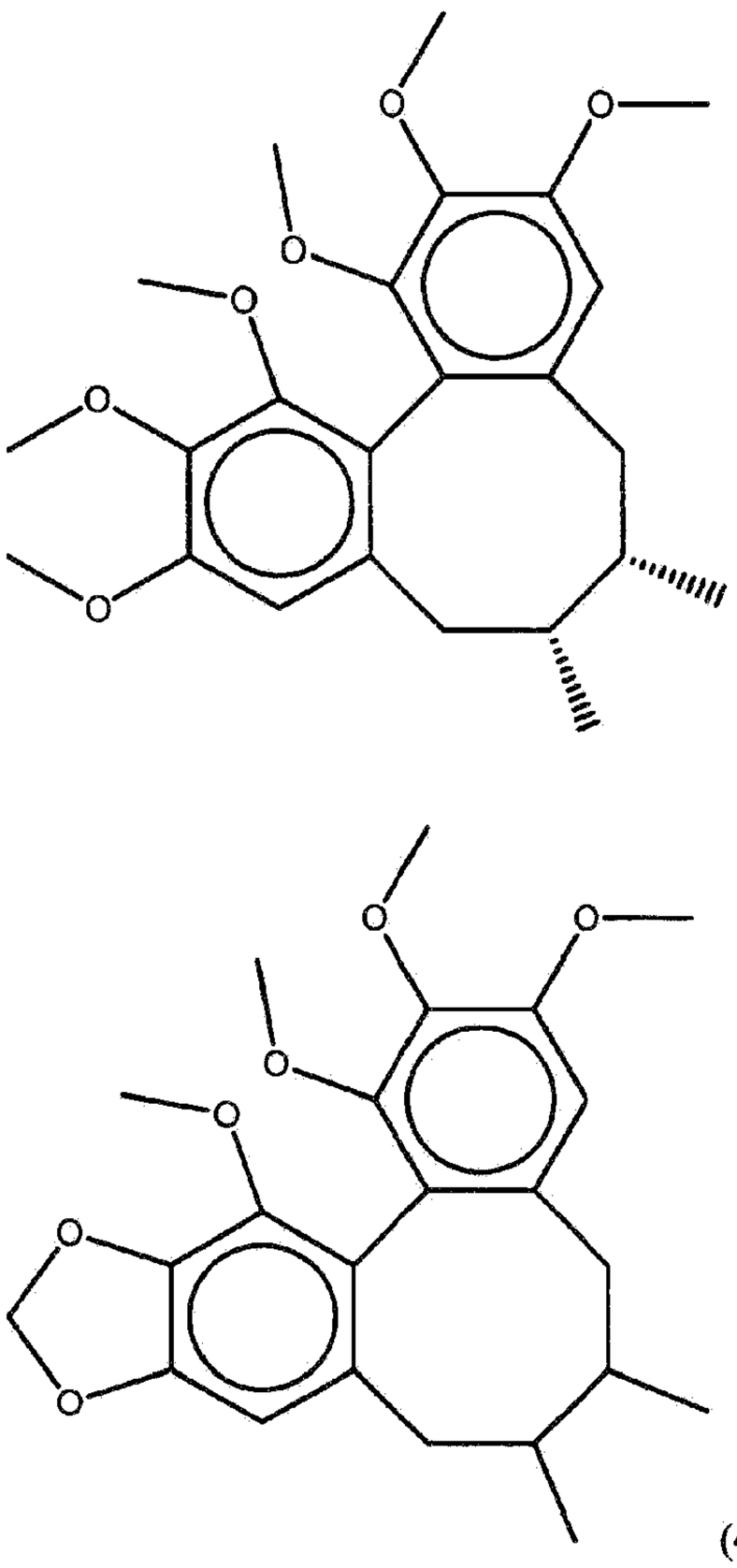
R^5, R^6 and R^7 are independently selected from H and methoxy; and

R^8 is H, OH or methoxy.
Compounds (44) and (45) fall within structure (I) and fall within the claims.

[0050] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:



(44),

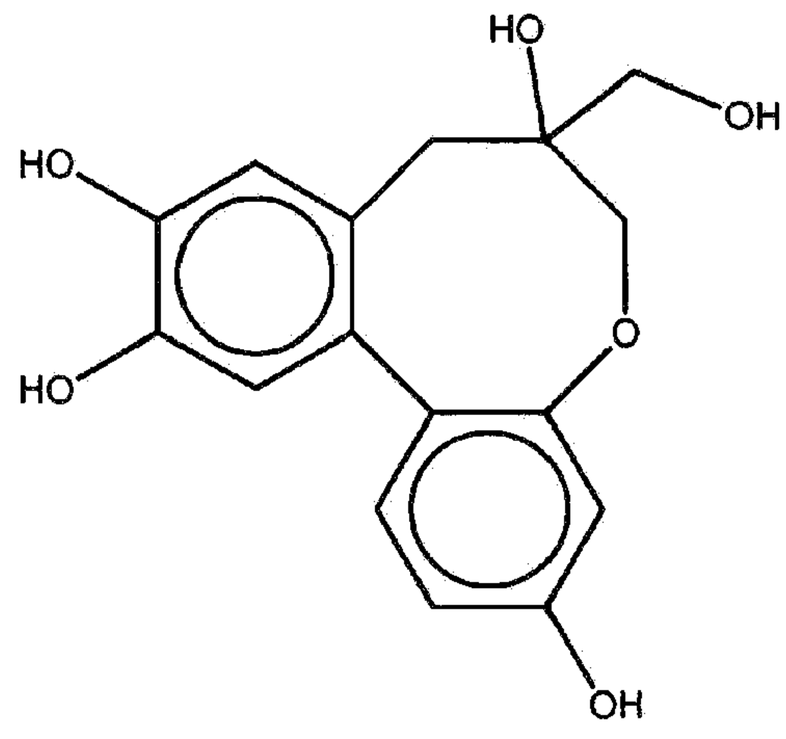


(45),

(46),*

* not within the claims

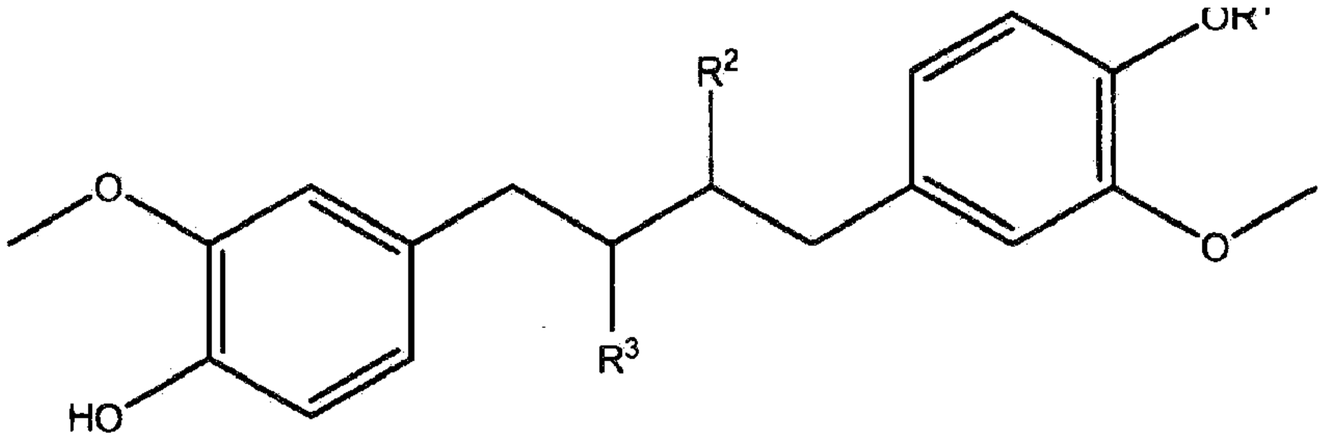
or



(47).*

* not within the claims

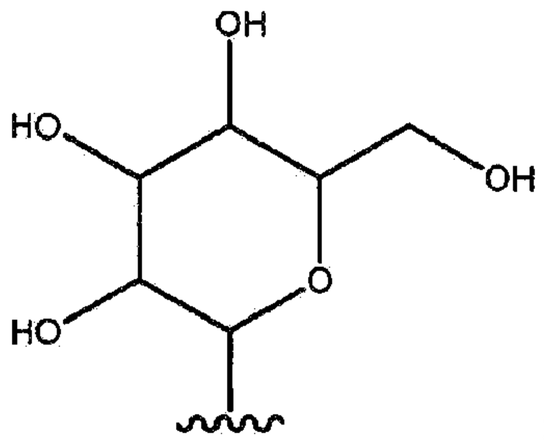
[0051] In embodiments, a bioactive, taste modulating, or salty taste modulating is a compound having the following structure:



(J1),

where

R^1 is H or



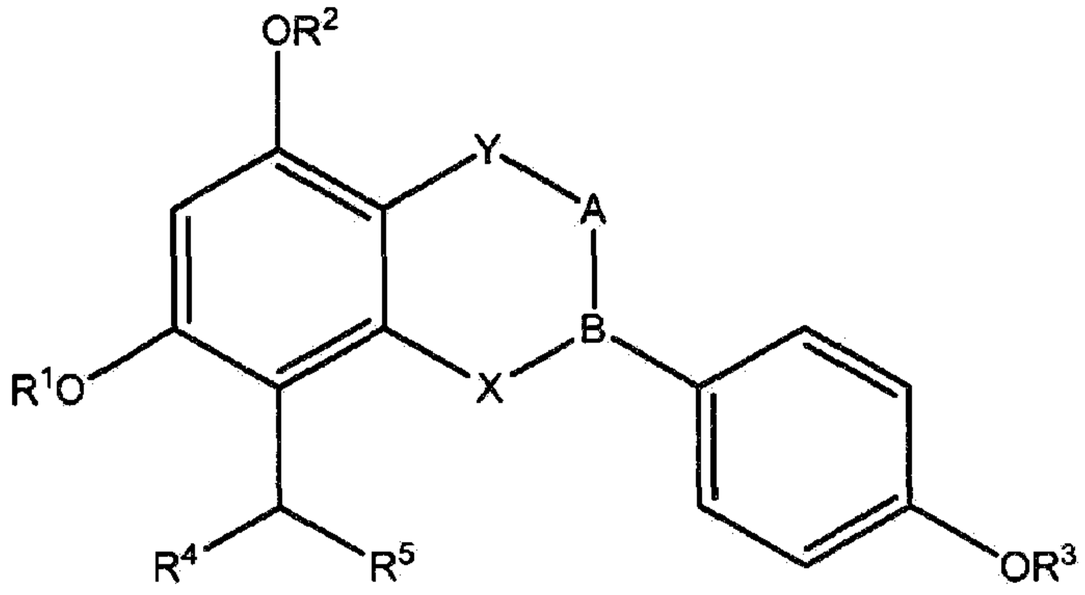
;

and

R^2 and R^3 are each independently C_1-C_3 alkyl or C_1-C_3 alcohol.

Compound (48) falls within structure (J1) and falls within the claims.

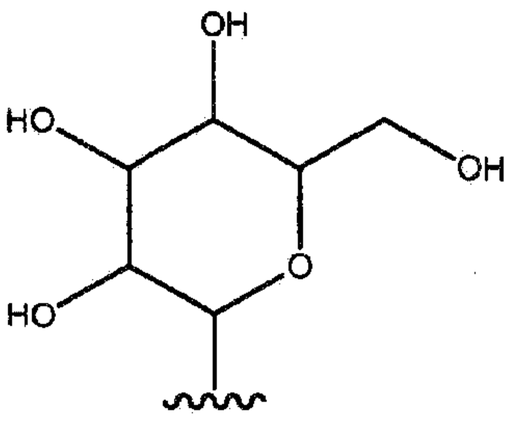
[0052] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims):



(J2),

where

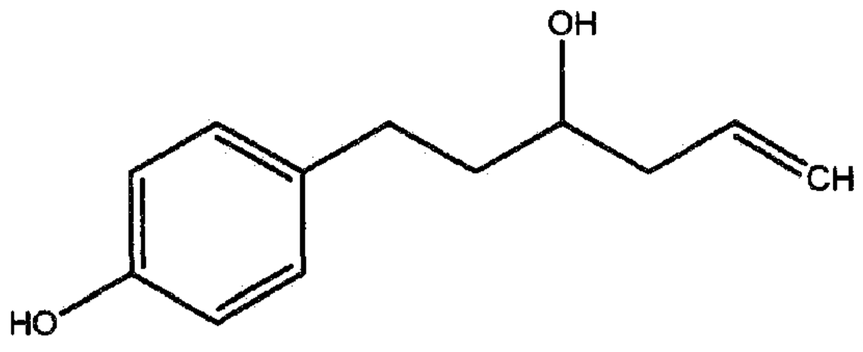
R^1 is OH or



;

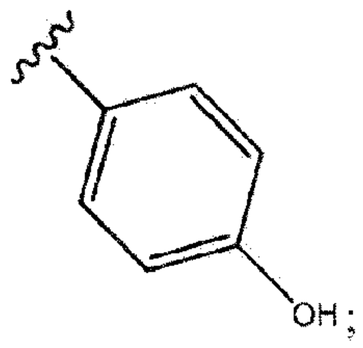
R^2 and R^3 are each independently OH or OCH_3;

R^4 is $CHC(CH_3)_2$ or



;

R^5 is H or

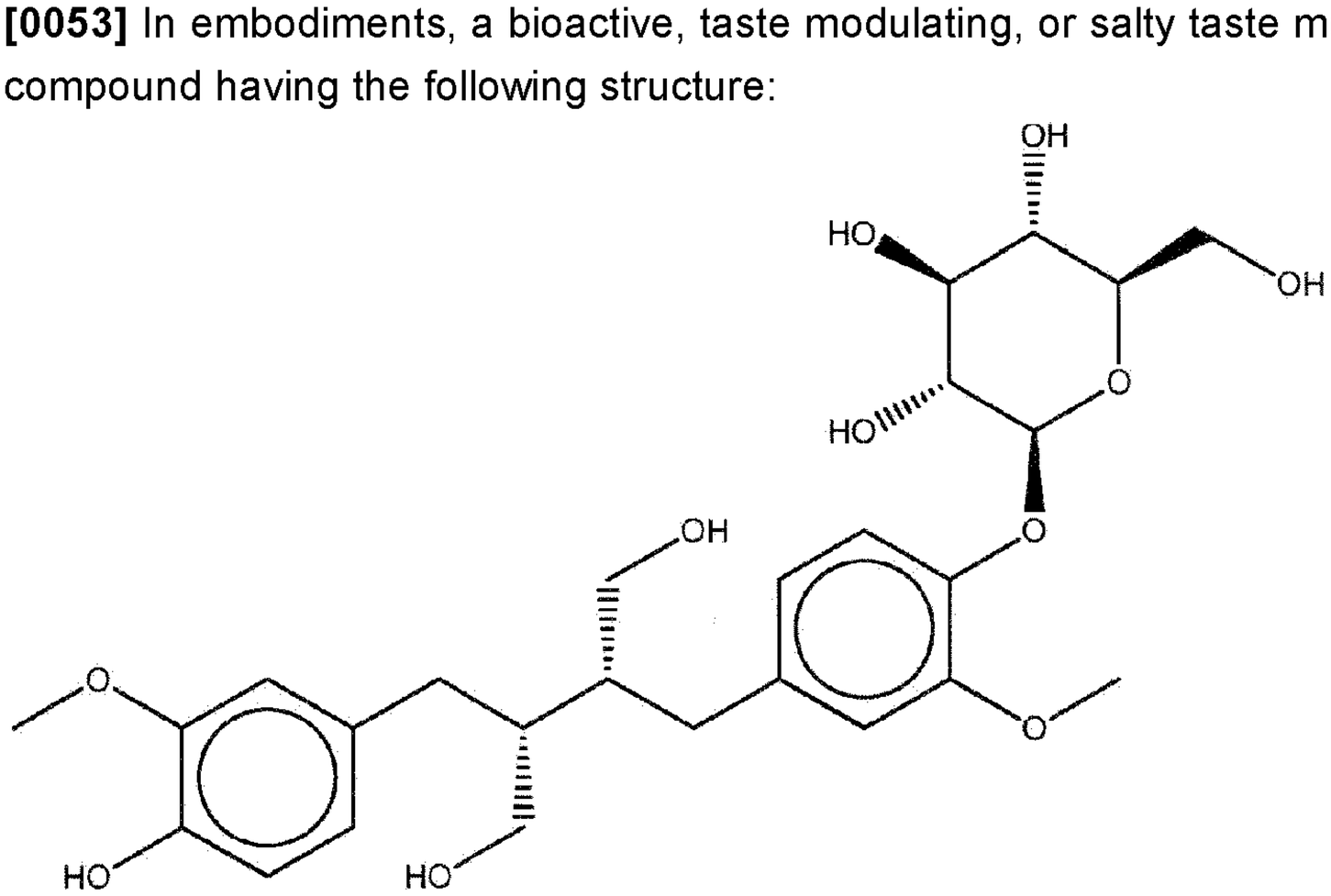


;

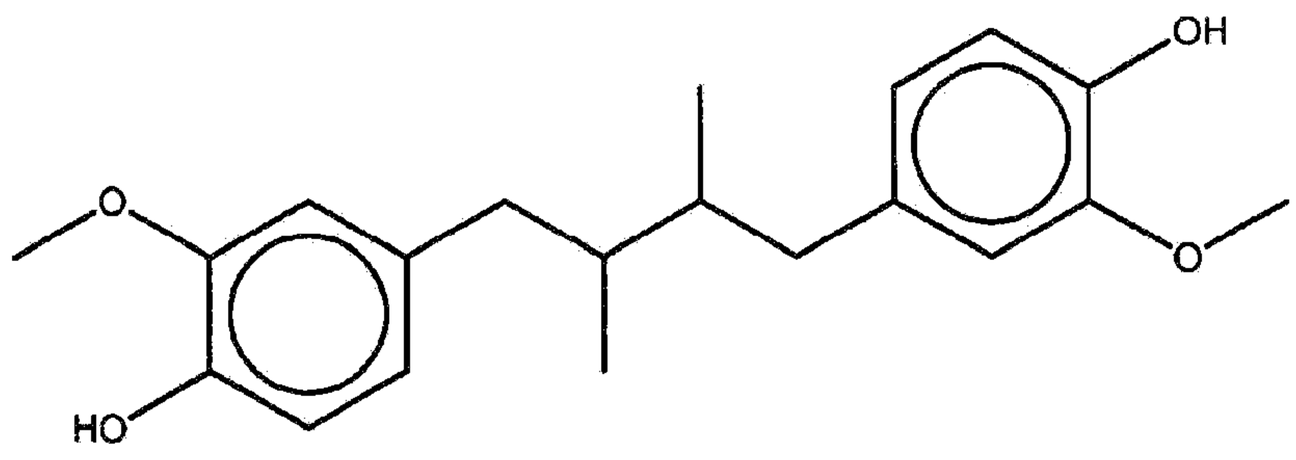
X is C=O or O; and

Y is C=O or O, provided that when X is O, Y is C=O, or when X is C=O, Y is O.

[0053] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:

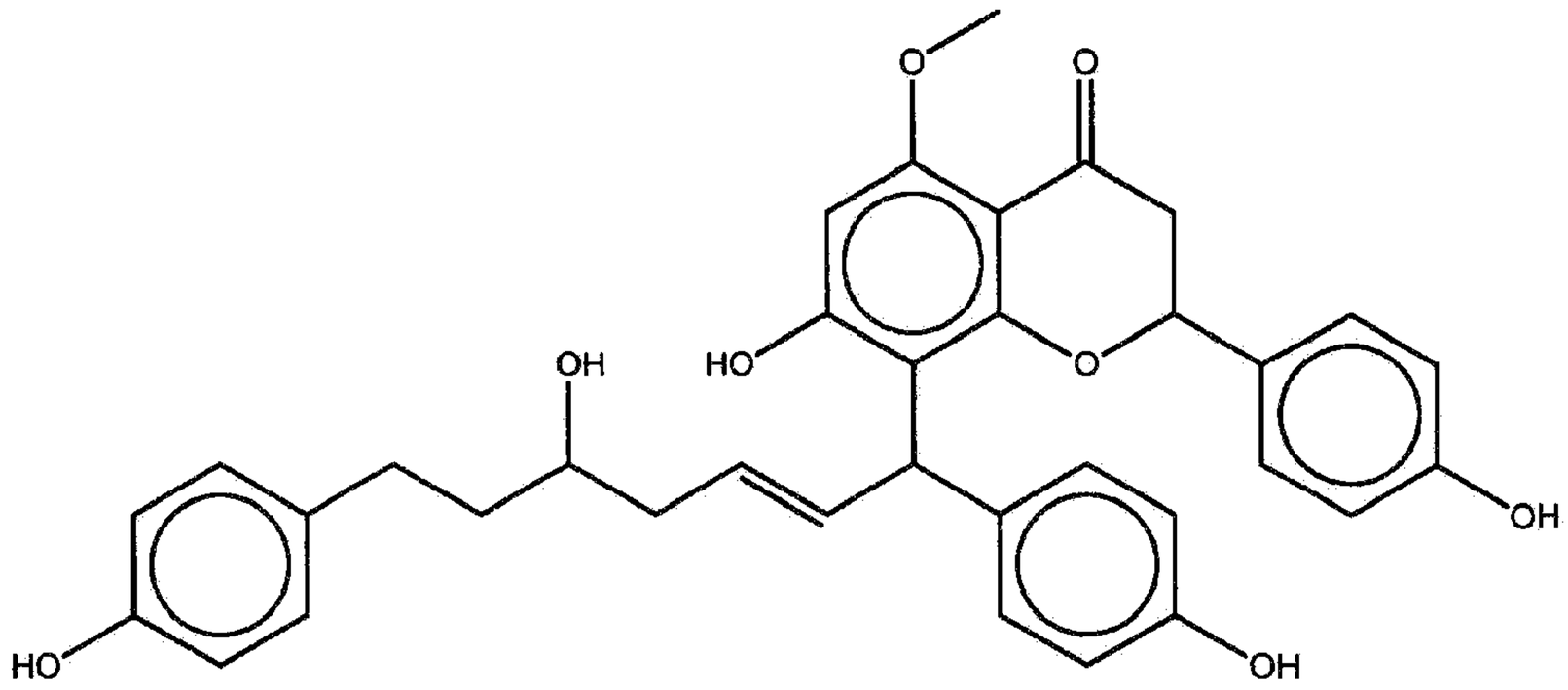


(48),



(49),*

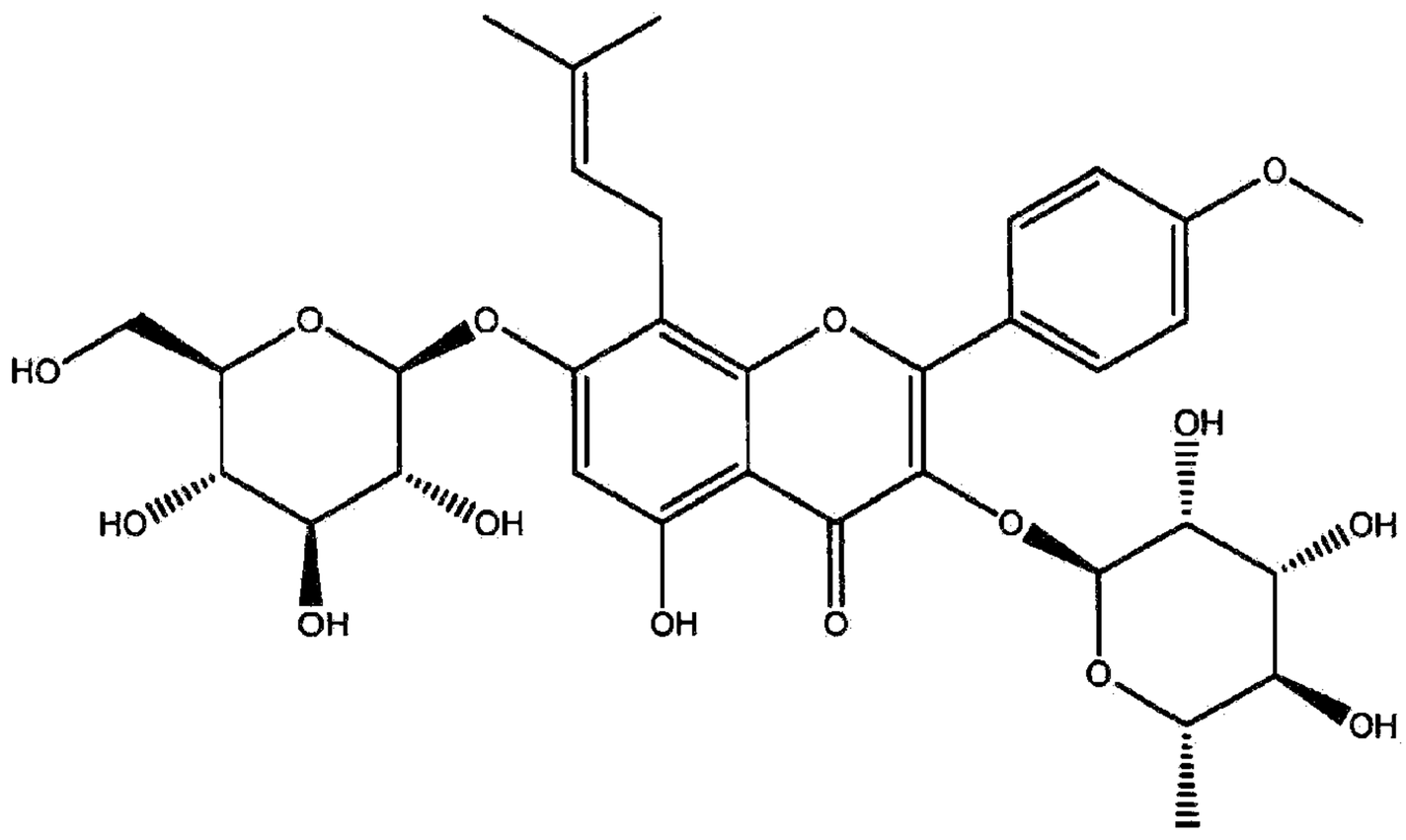
* not within the claims



(50),*

* not within the claims

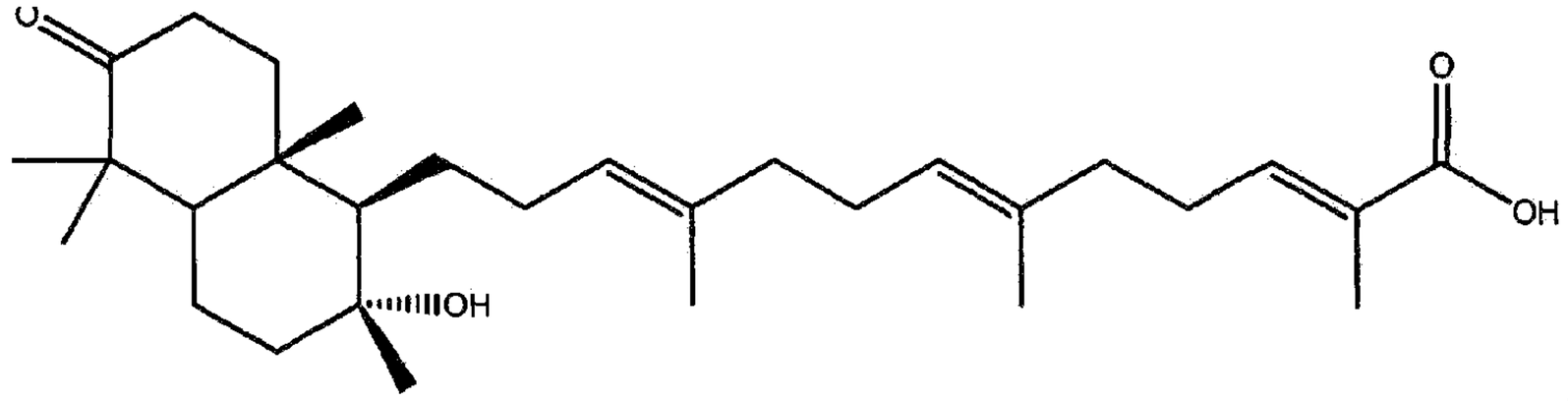
or



(51).*

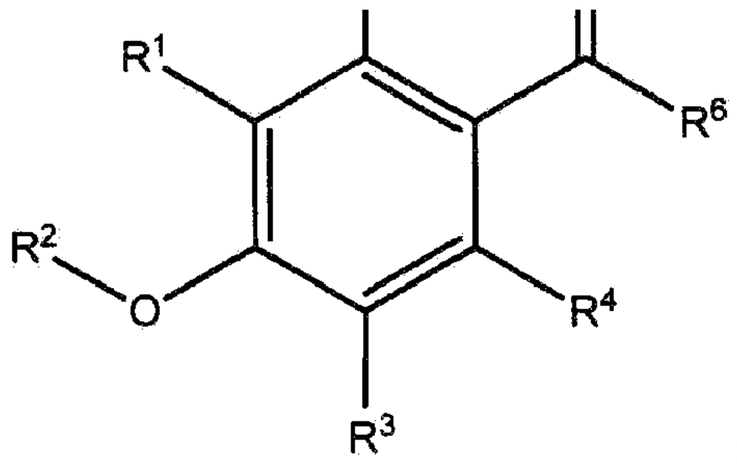
* not within the claims

[0054] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims):



(**K**, 52).

[0055] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:

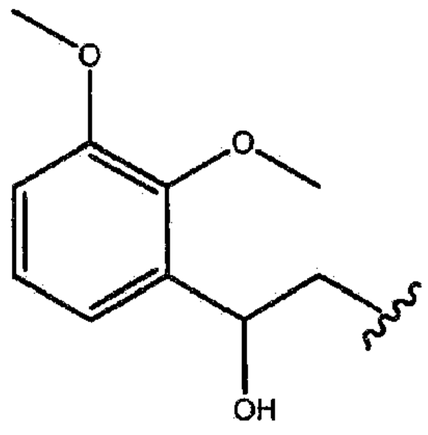


(L),

where:

R^1 is H, CH_2CH_2OH, or methoxy;

R^2 is methyl or



;

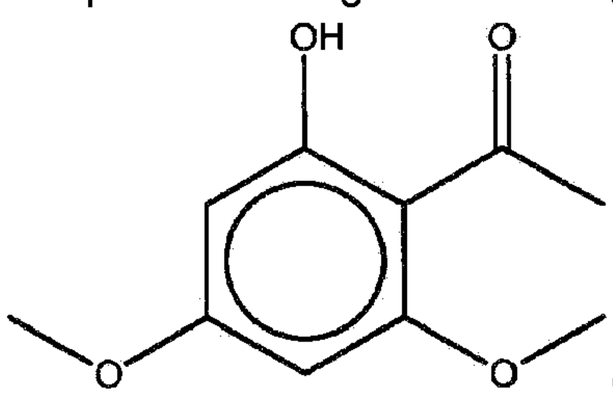
R^3 and R^5 are independently H or OH;

R^4 is H or methoxy;

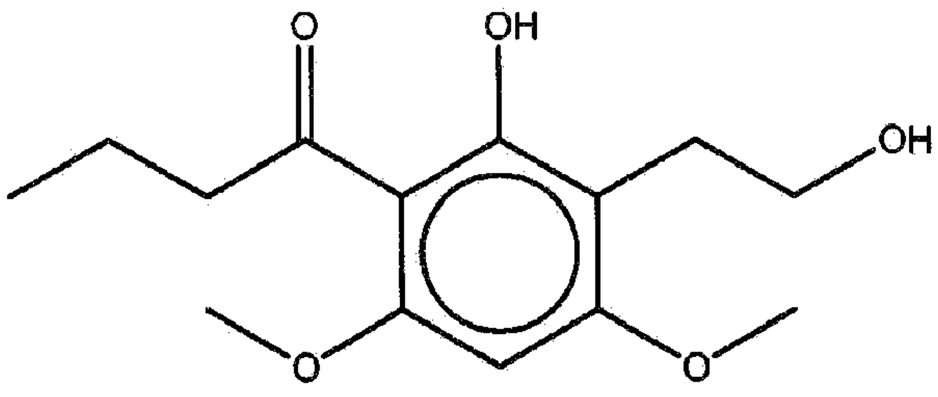
R^6 is C_1-C_3 alkyl or C_1-C_3 alkoxy.

Compound (53) falls within structure (L) and falls within the claims.

[0056] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:



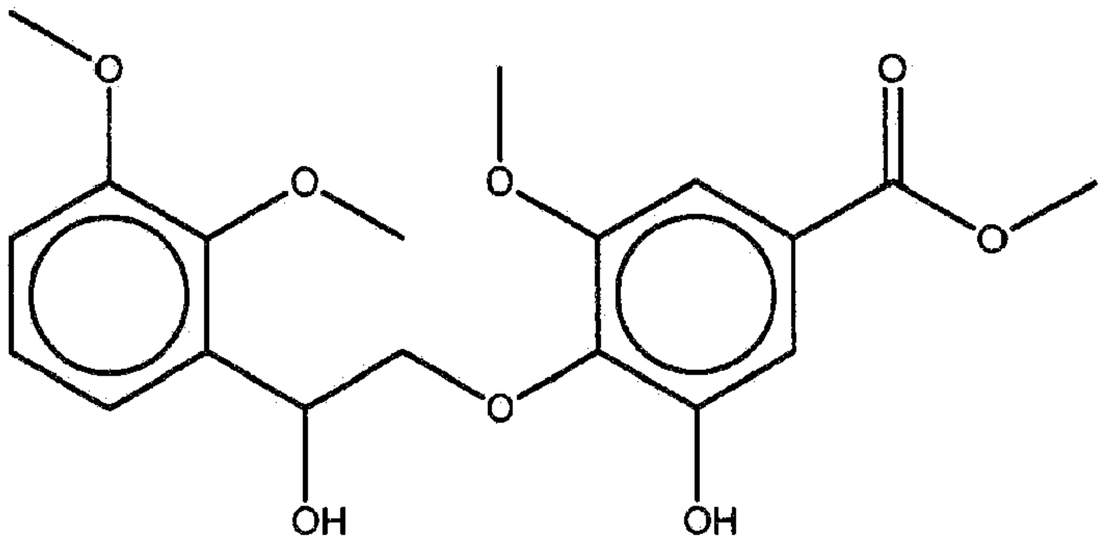
(53),



(54), *

* not within the claims

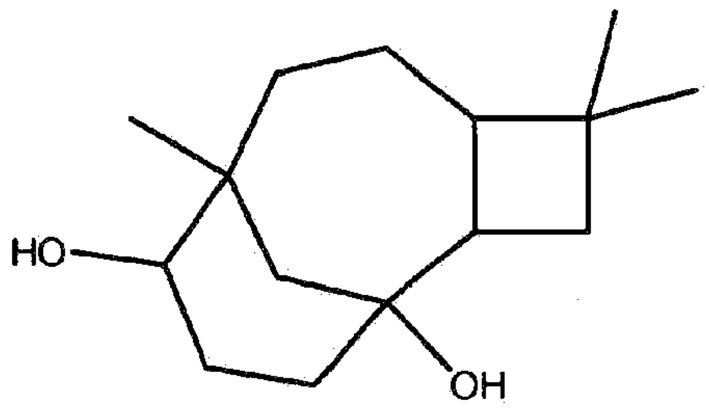
or



(55).*

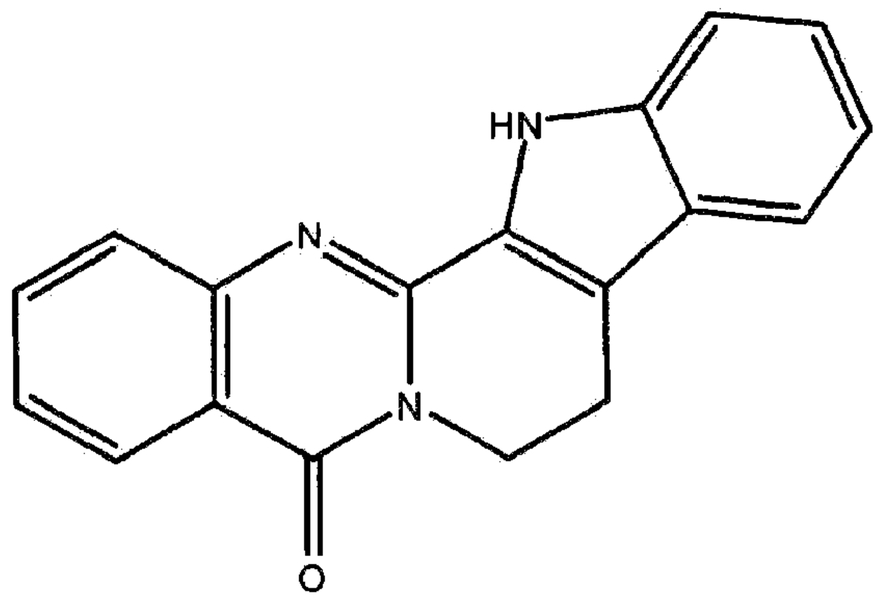
* not within the claims

[0057] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:



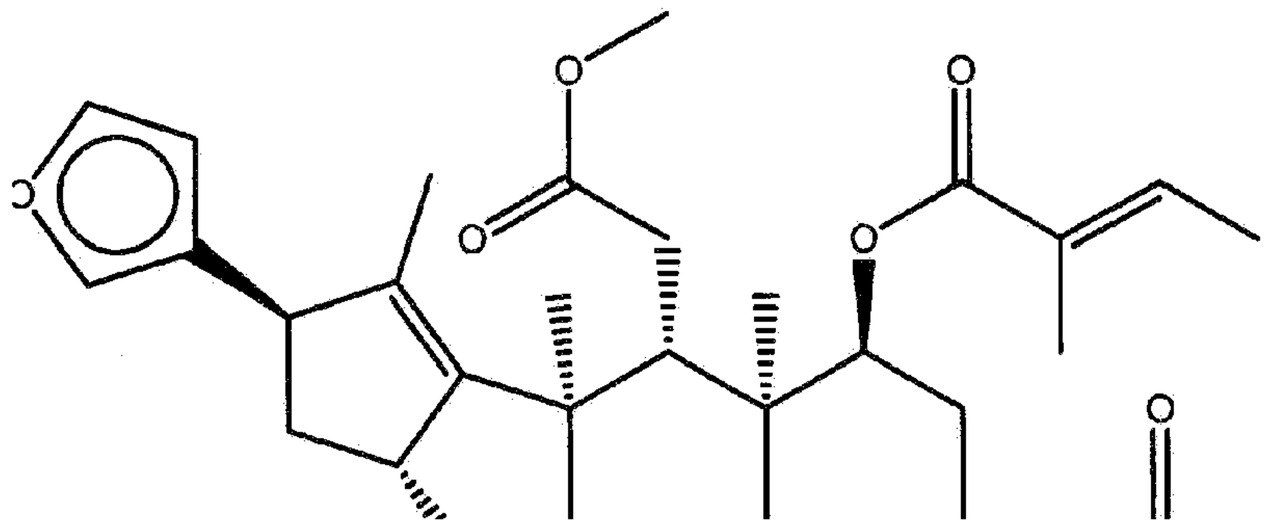
(**M**, 56).

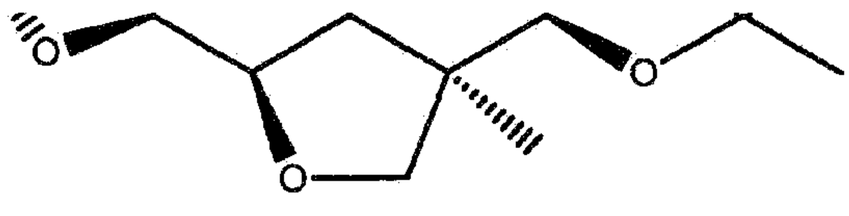
[0058] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims):



(**N**, 57).

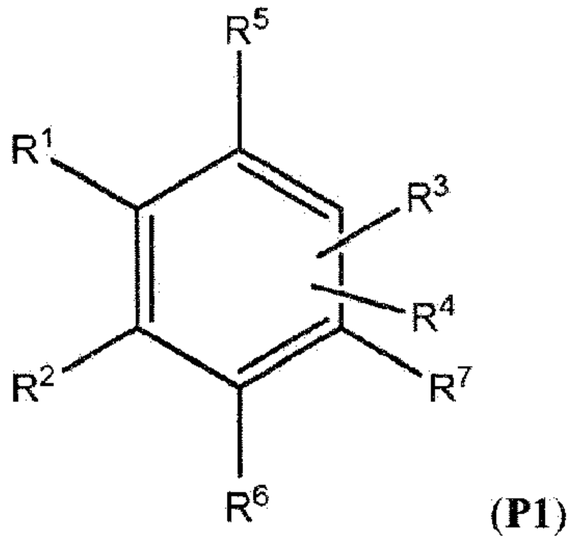
[0059] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims):





(**O**, 58).

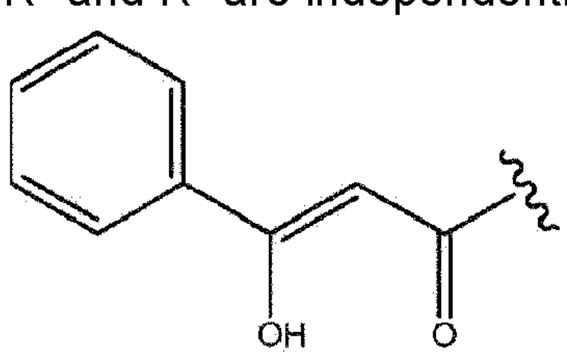
[0060] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims):



(**P1**)

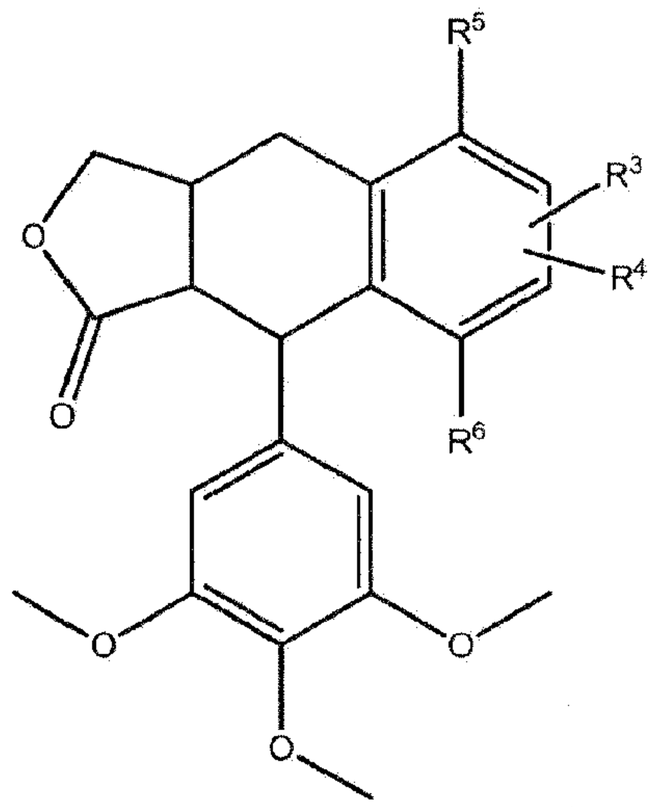
where

R^1 and R^2 are independently H, methoxy, or



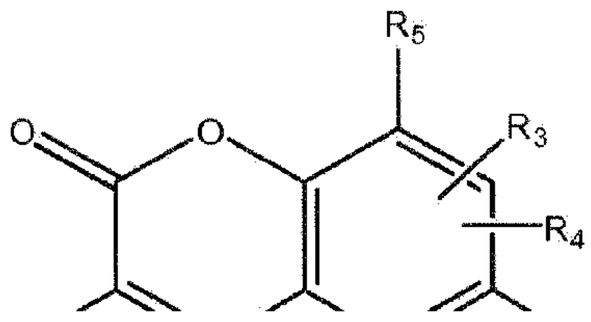
or R^1 and

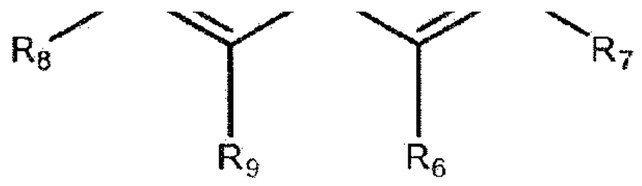
R^2 together with the carbons to which they are bound form a six membered ring structure with various substituents to form a compound having a structure of



(**P1A'**)

or

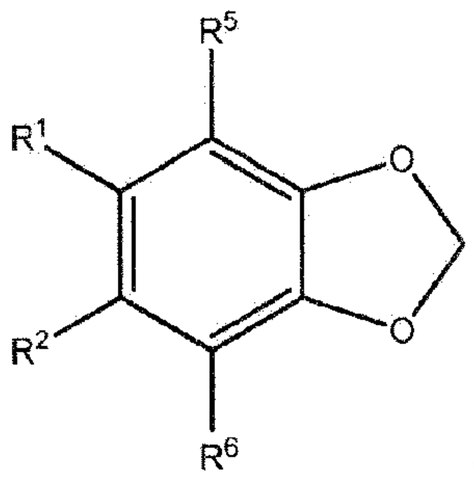




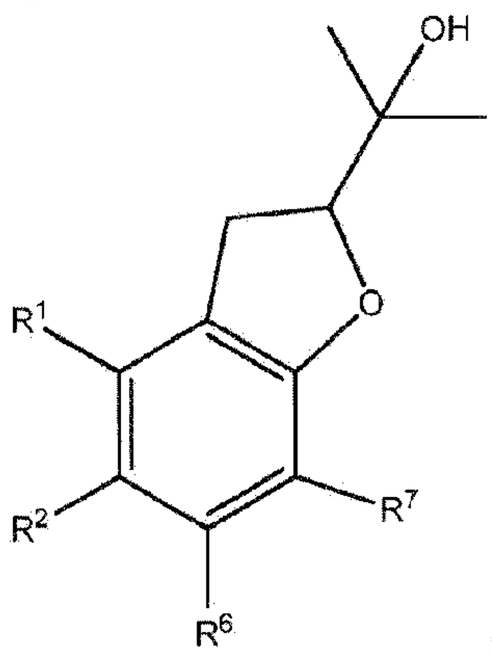
(P1A'')

where R^8 and R^9 are each
independently H, benzyl, or $C(CH_3)_2CHCH_2$;

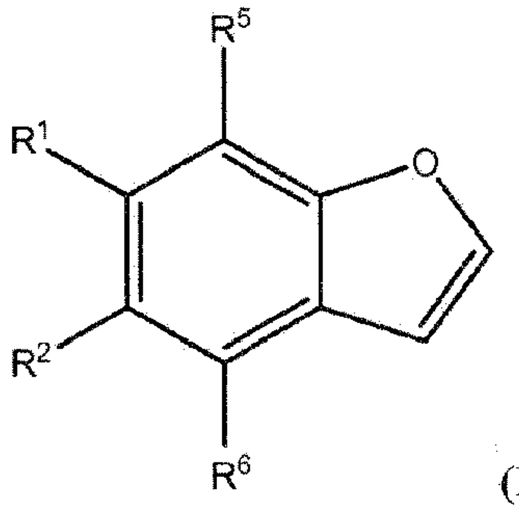
R^3 and R^4 together with the carbons to which they are bound form a five membered aromatic or non-aromatic ring having a nitrogen heteroatom or one or two oxygen heteroatoms to form a compound having the following structure



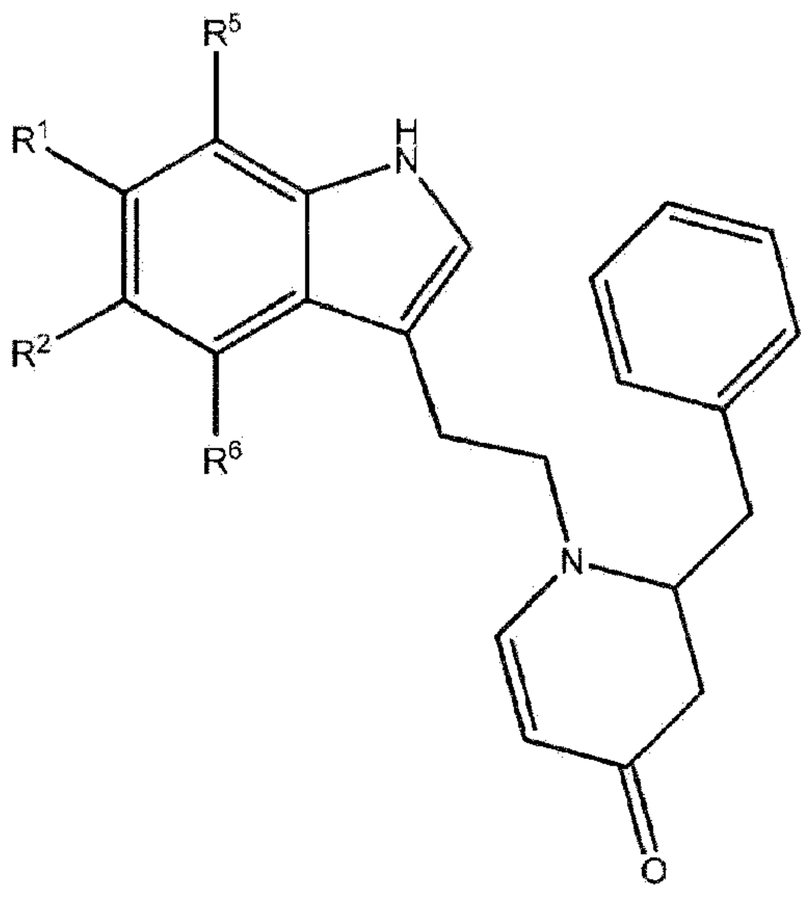
(P1B-1),



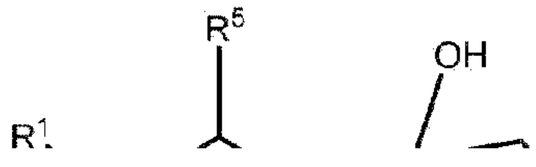
(P1B-2),

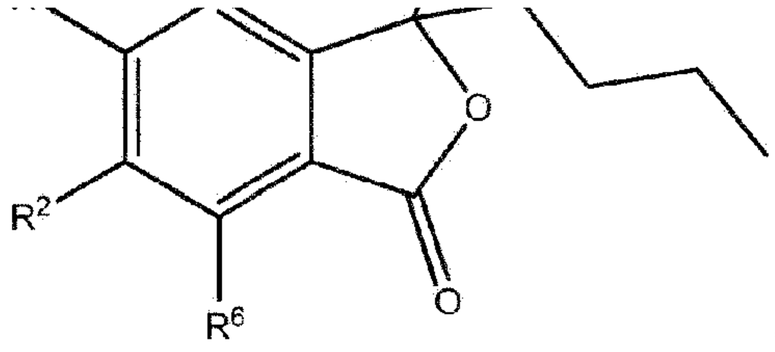


(P1B-3),

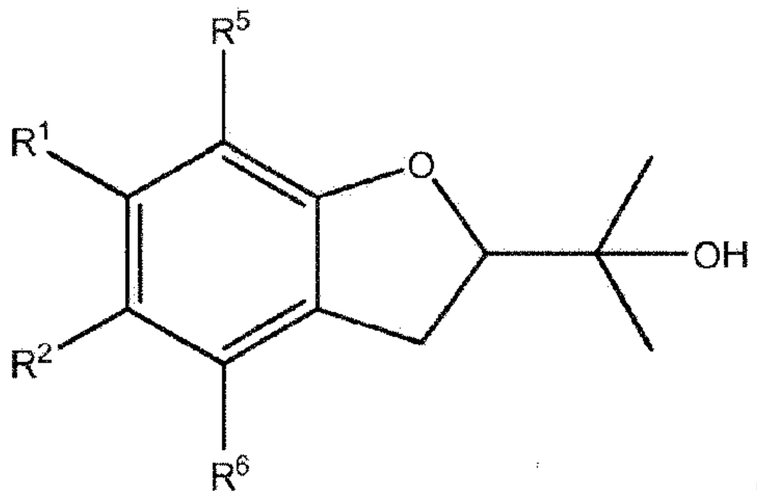


(P1B-4),



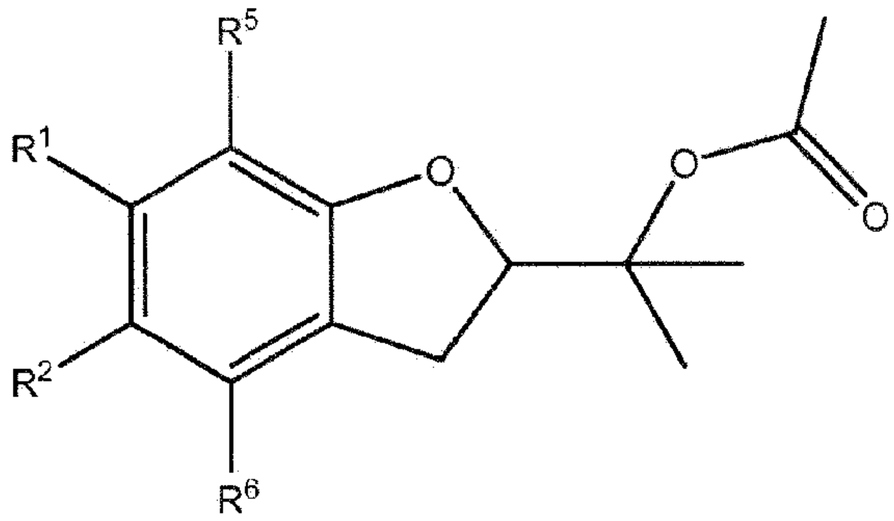


(P1B-5),



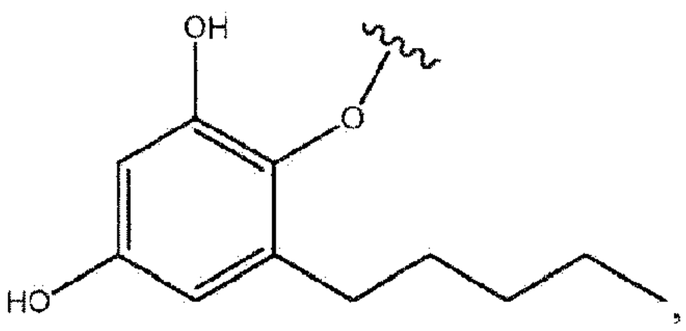
(P1B-6),

or



(P1B-7);

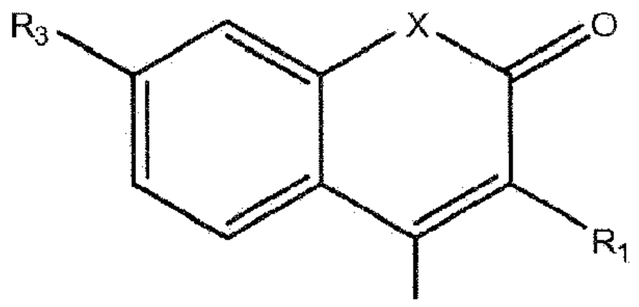
R^5 and R^6 are independently H, OH, methoxy, $OCH_2CH(OH)C(CH_3)_2OH$, $OCH_2CHC(CH_3)_2$, and

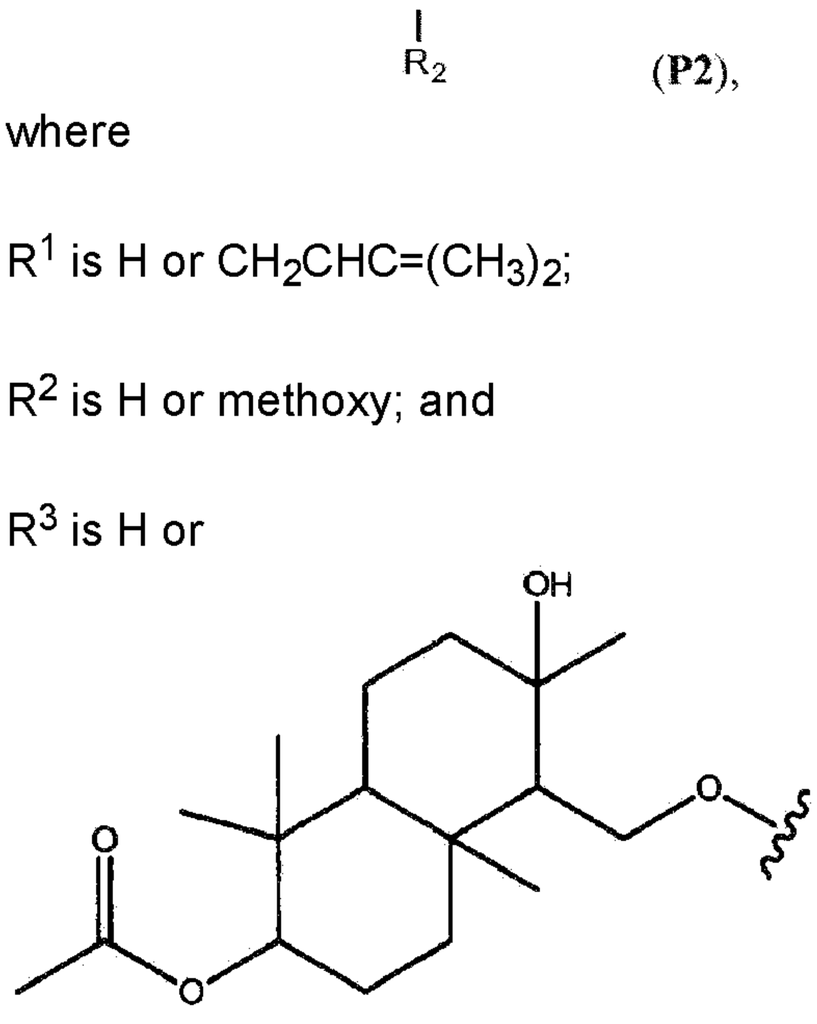


provided that R^5 is not present when R^3 and R^4 together result in a compound having a structure of Formula **P1B-2;** and

R^7 is $COCH(CH_3)_2$, provided that R^7 is not present when R^3 and R^4 together form a compound having a structure of Formula **P1B-1, P1B-2, P1B-3, P1B-4, P1B-5, P1B-6,** or **P1B-7.**

[0061] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:





(P2),

where

R^1 is H or $CH_2CHC=(CH_3)_2$;

R^2 is H or methoxy; and

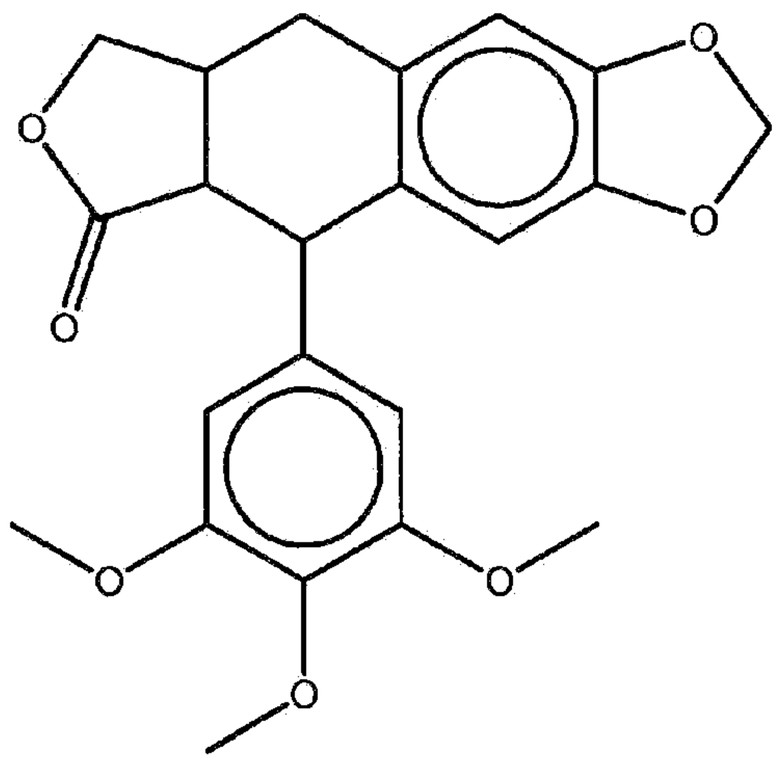
R^3 is H or

and

X is N or O.

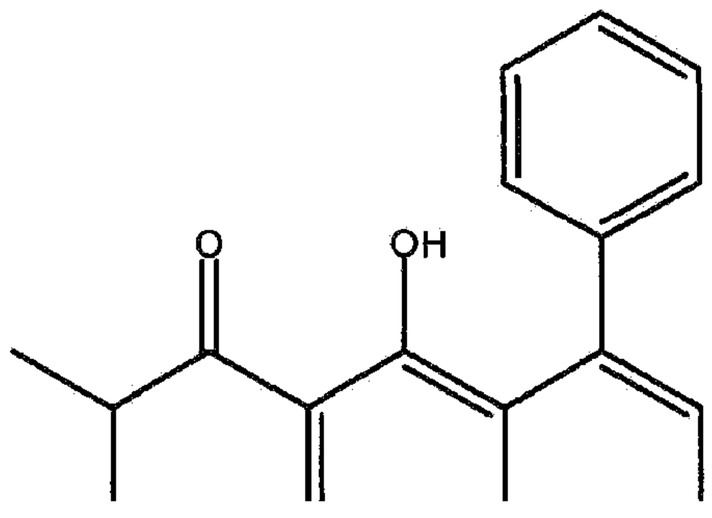
Compounds (62) and (66) fall within structure (P2) and fall within the claims.

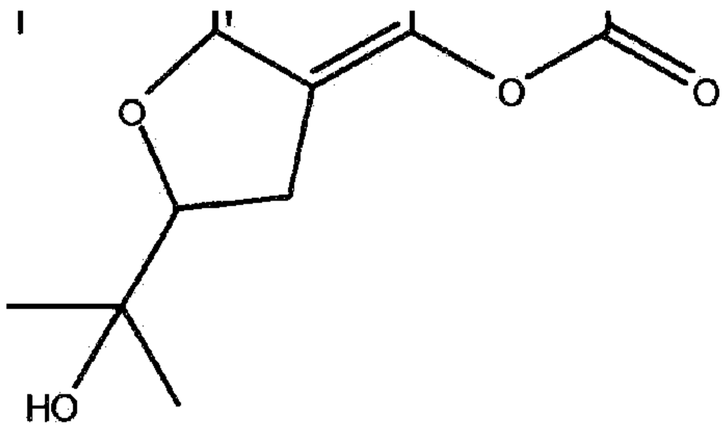
[0062] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:



(59),

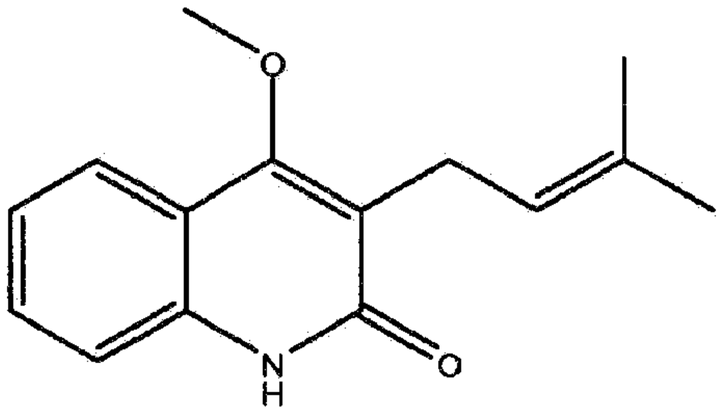
* not within the claims





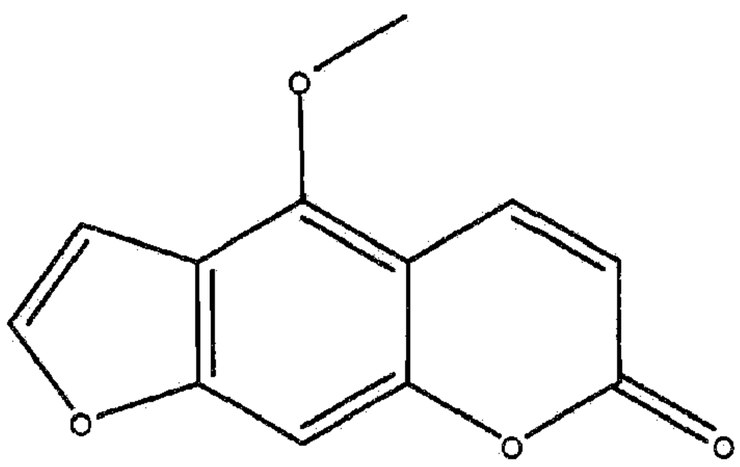
(60),*

* not within the claims

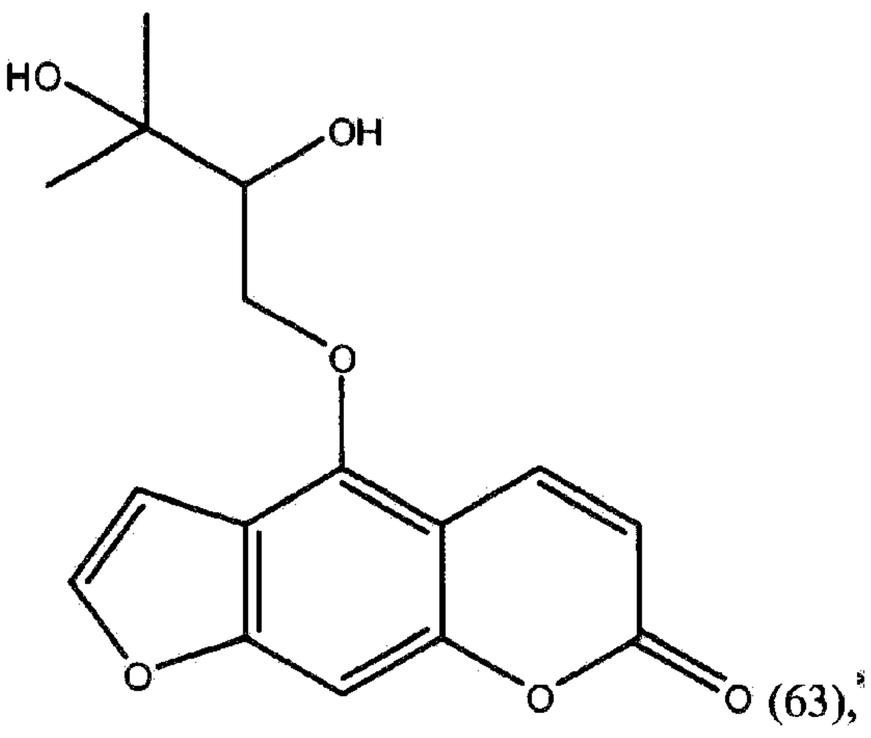


(61),*

* not within the claims

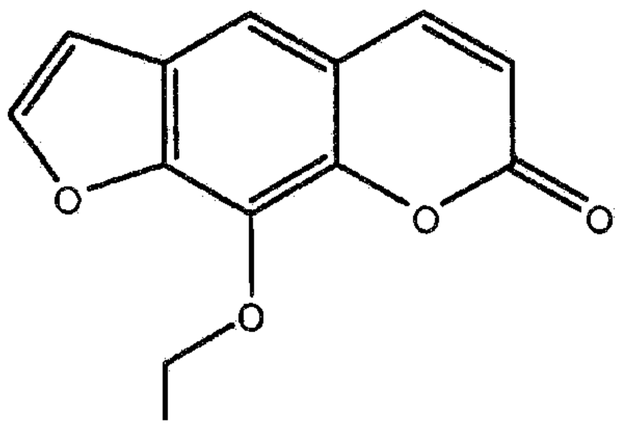


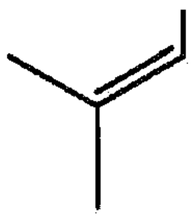
(62),



(63),*

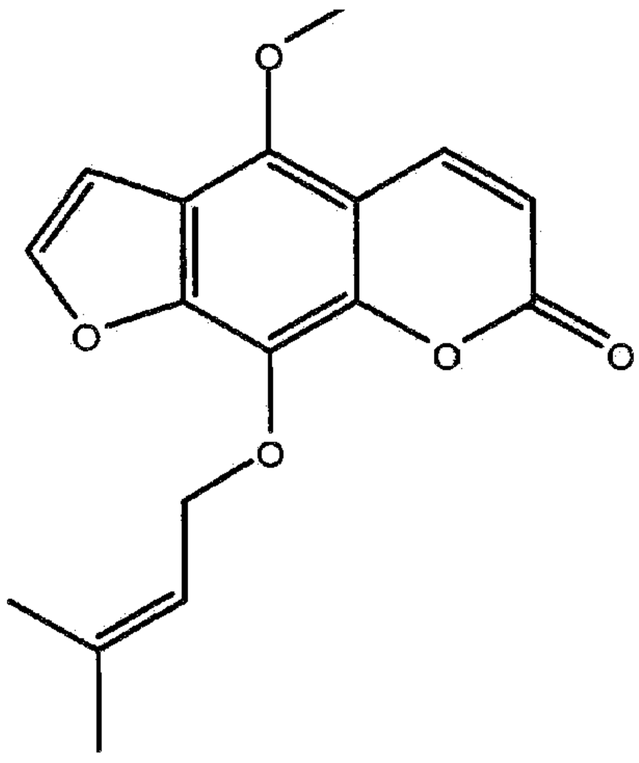
* not within the claims





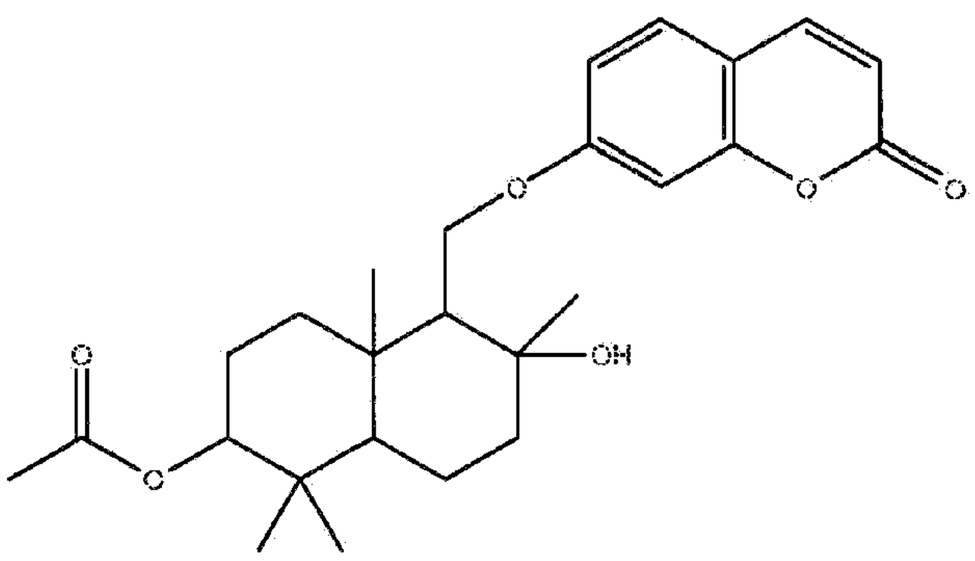
(64),

* not within the claims

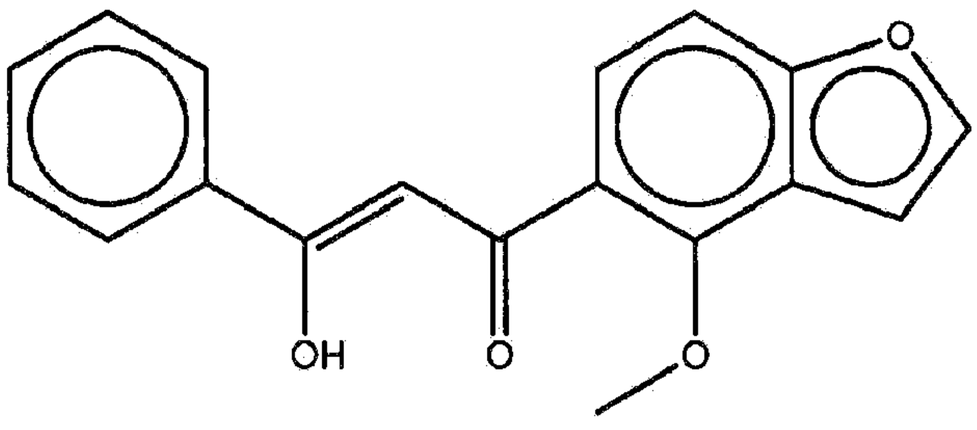


(65),

* not within the claims

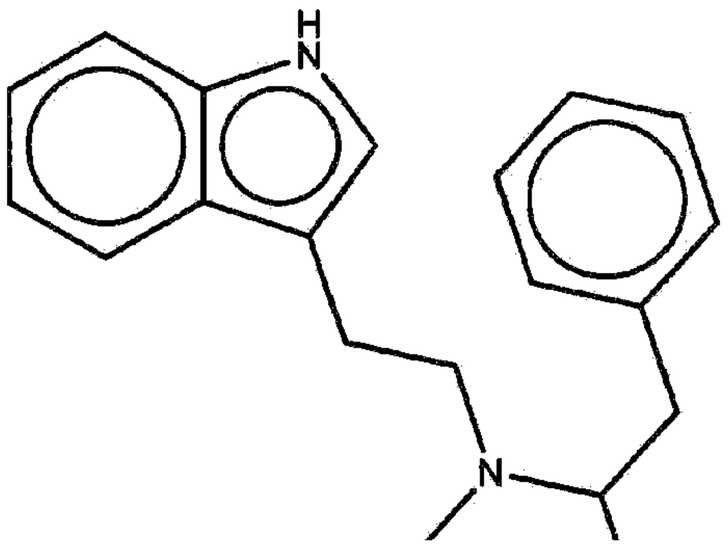


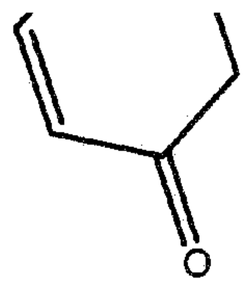
(66),



(67),

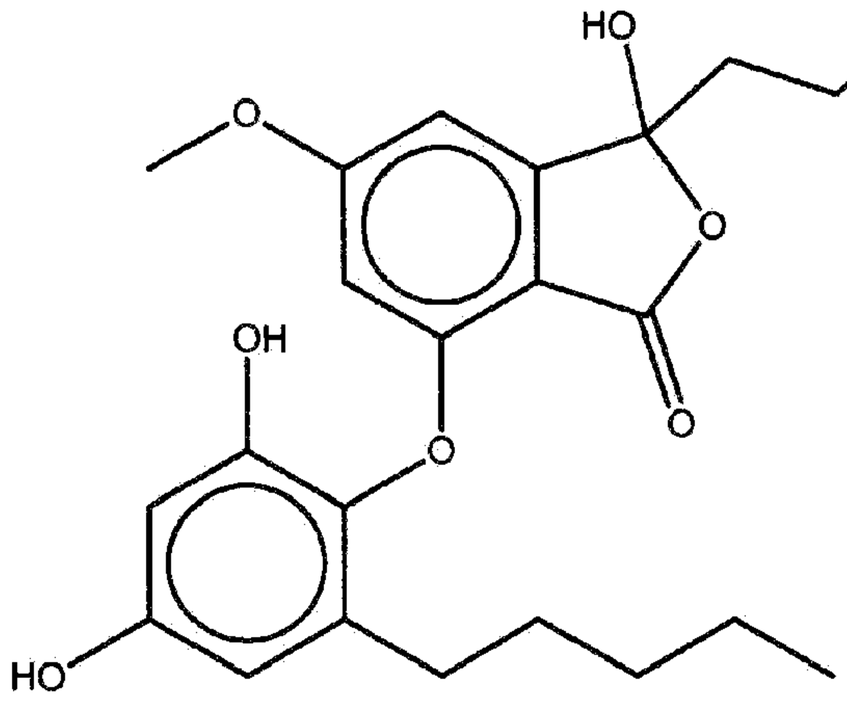
* not within the claims





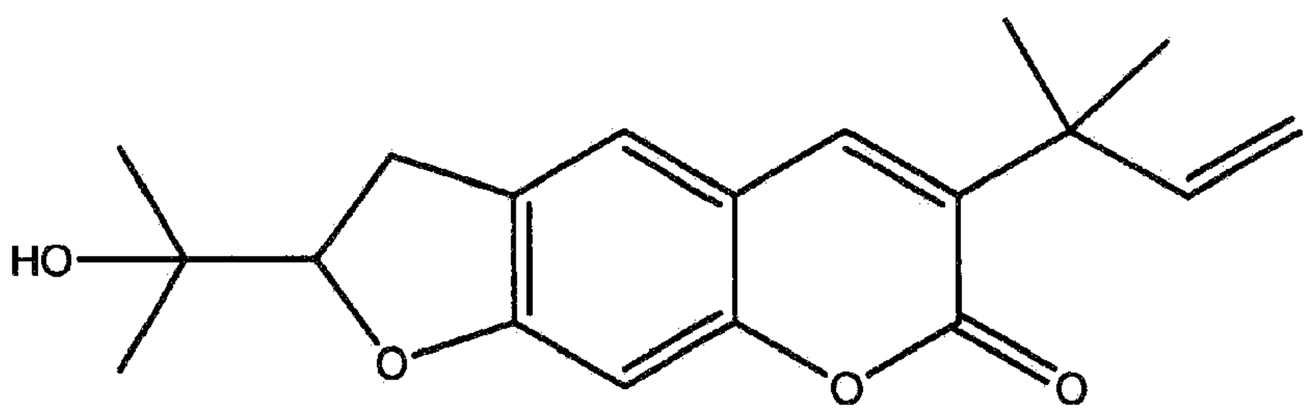
(68),'

* not within the claims



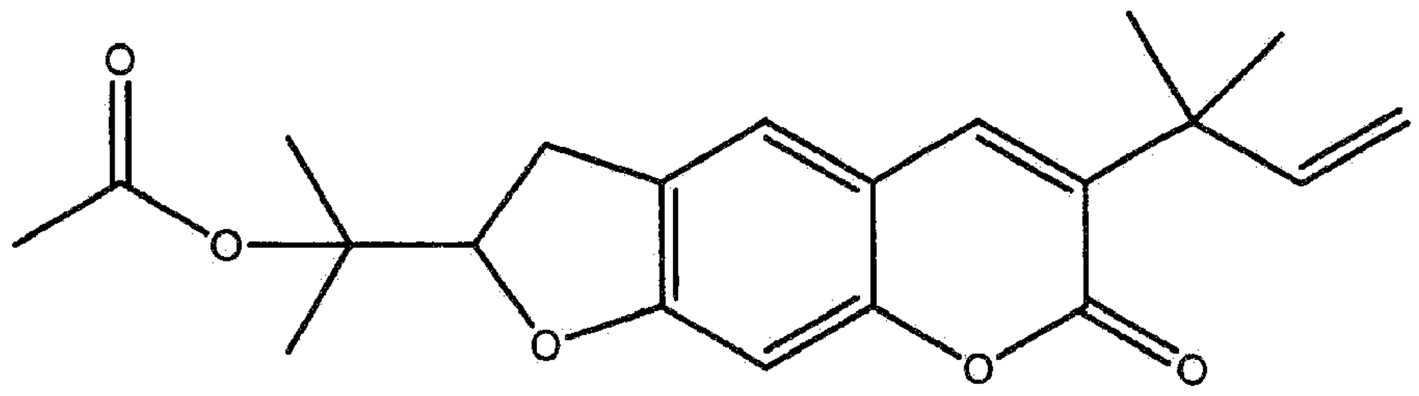
(69),'

* not within the claims



(70),

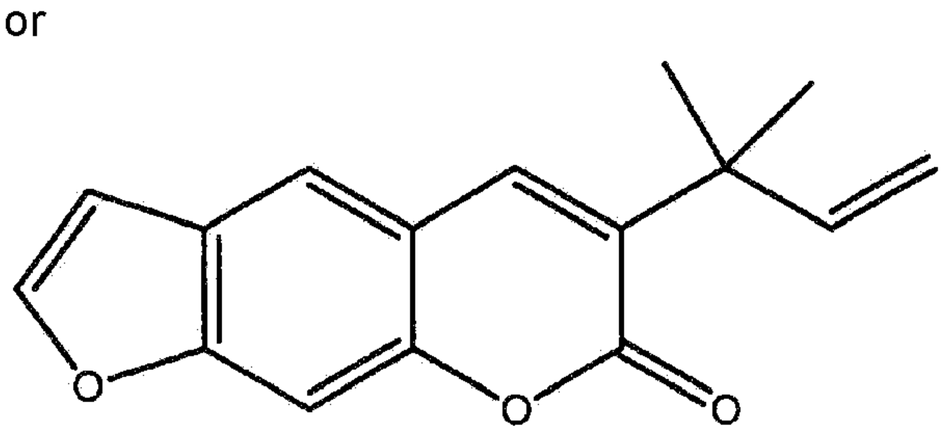
* not within the claims



(71),

* not within the claims

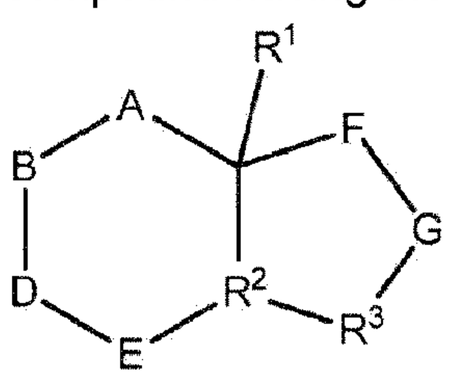
or



(72).

* not within the claims

[0063] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:



(Q),

where:

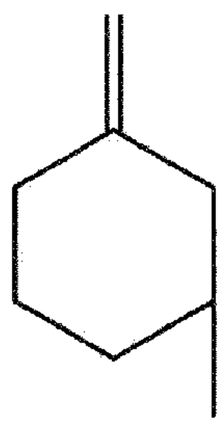
R^1 is H or methyl;

R^2 is CR^4 or C;

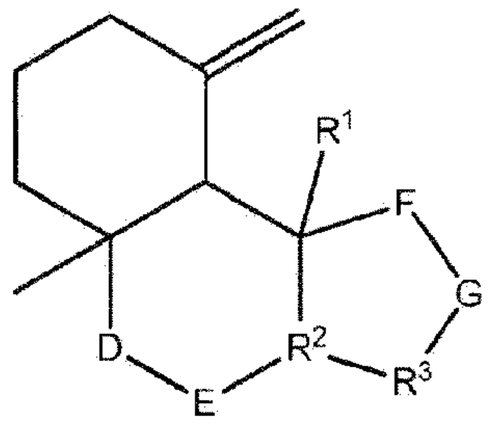
R^3 is CH_2, CH or $C=CH_2$, provided that when R^2 is C, R^3 is CH;

R^4 is H, OH, or methyl;

A is CH_2 or A and B together form

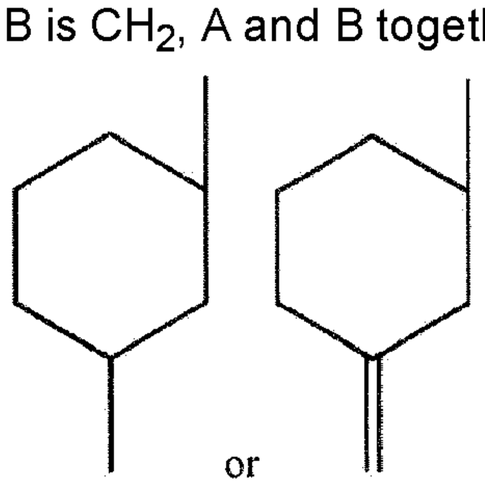


to form a compound having the following structure



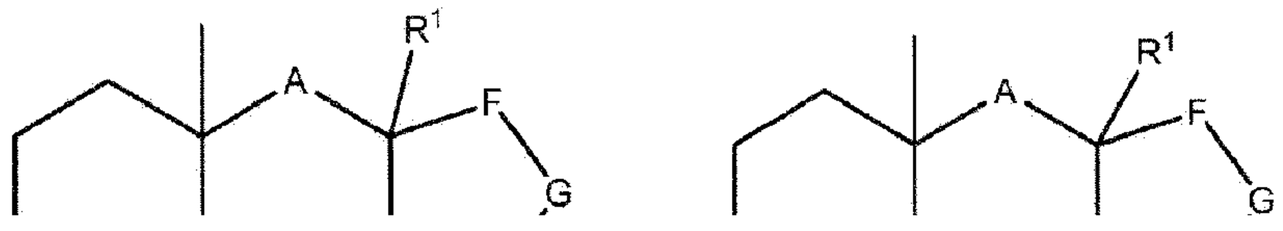
(Q');

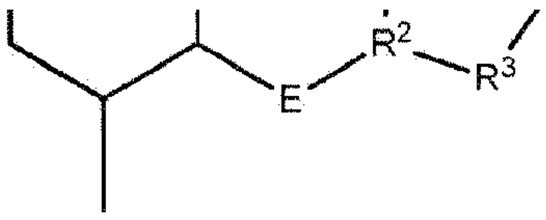
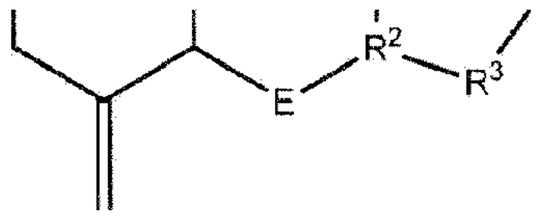
B is CH_2, A and B together form the structure indicated above, or B and D together form



or

to form a compound having the following structure

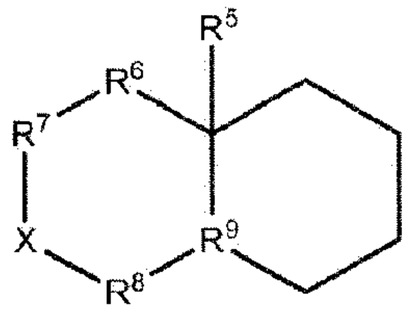


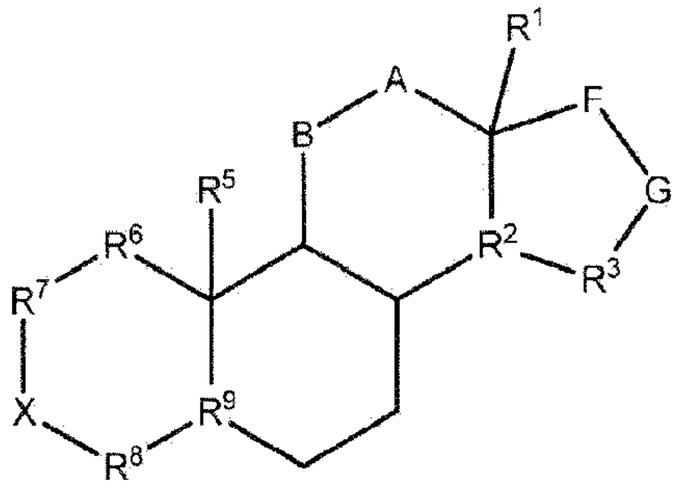
(**Q''**) or (**Q'''**),

provided that when B and D together form a ring to result in a compound having a structure of Formula Q", a double bond exists between D and E;

D is CH_2, B and D together form a structure indicated above, D and E together form



to form a compound having the following structure



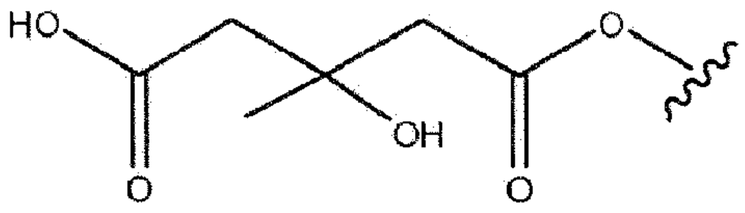
(**Q''''**),

where

R^5 is methyl or CHO,

R^6 is CH or CH_2,

R^7 is CH or CHR^{10}, where R^{10} is H or



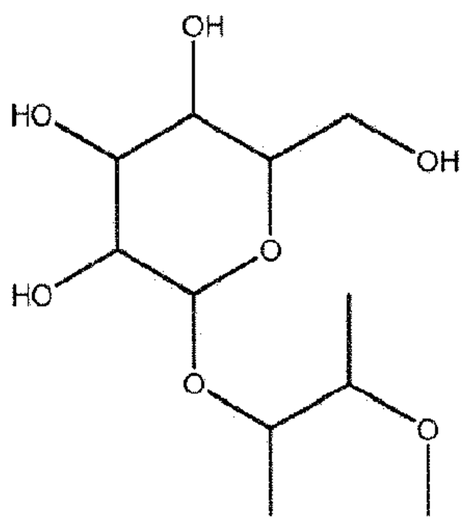
,

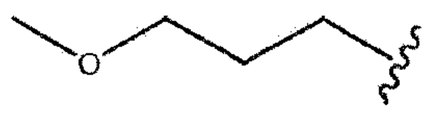
provided that when R^6 is CH, R^7 is CH,

R^8 is CH or $CR^{11}R^{12}$ where R^{11} and R^{12} are independently selected from H and methyl,

R^9 is C or CR^{13} where R^{13} is H or OH, provided that when R^8 is CH, R^9 is C,

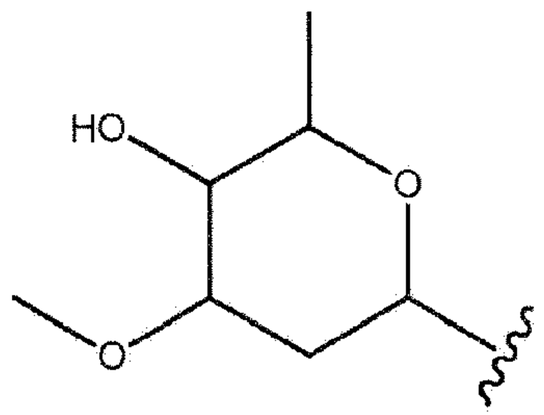
X is COR^{14} wherein R^{14} is H, CO, $COCH_3$,





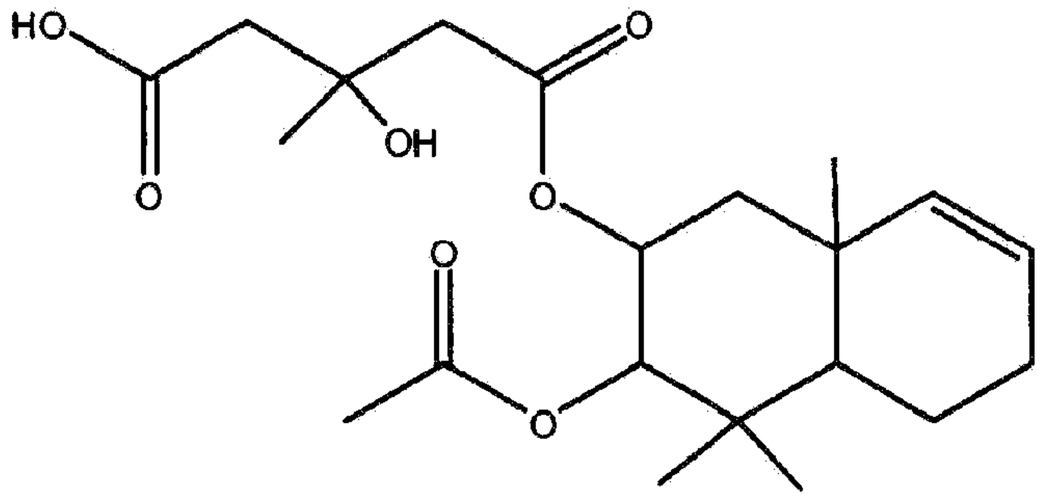
,

or

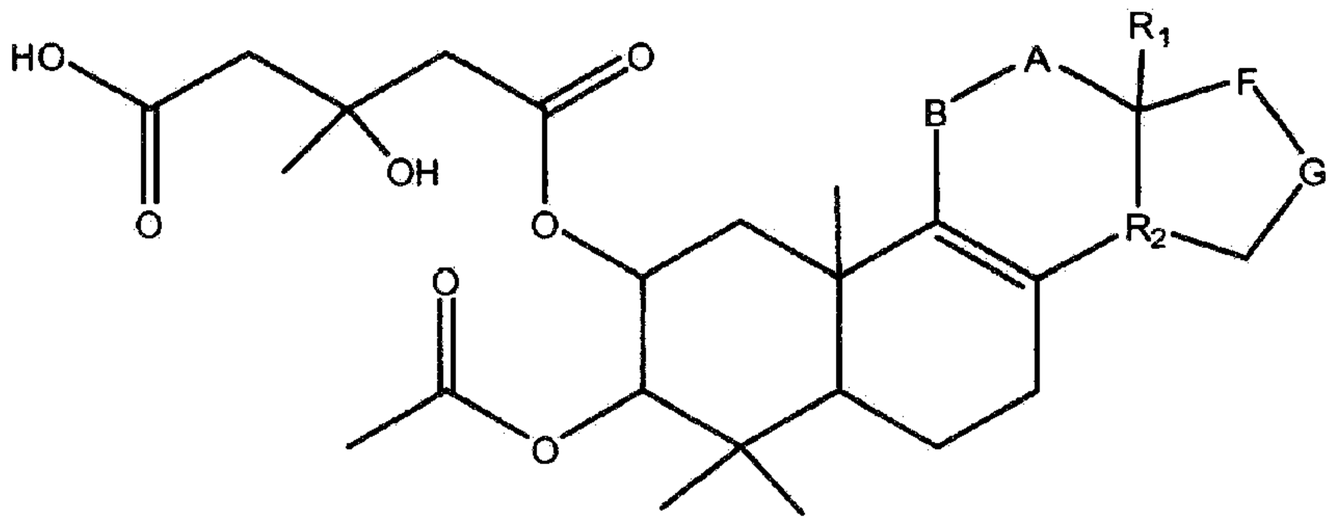


,

or D and E together form



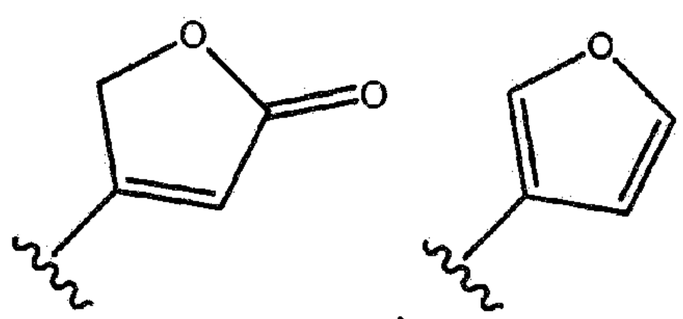
to form a compound having the following structure



(Q''''');

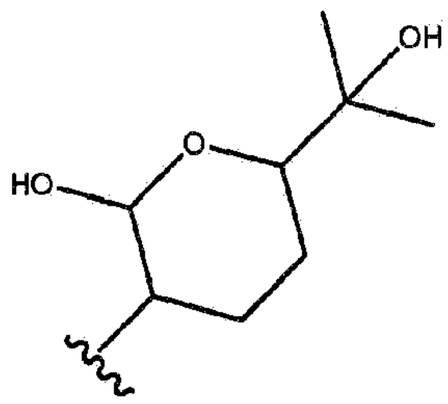
E is CH, CH_2 or a structure formed between D and E indicated above, provided that when B and D together form the structure indicated above, E is CH;

F is O, $CCHCH_3$, or CHR^{15} where R^{15} is



;

or



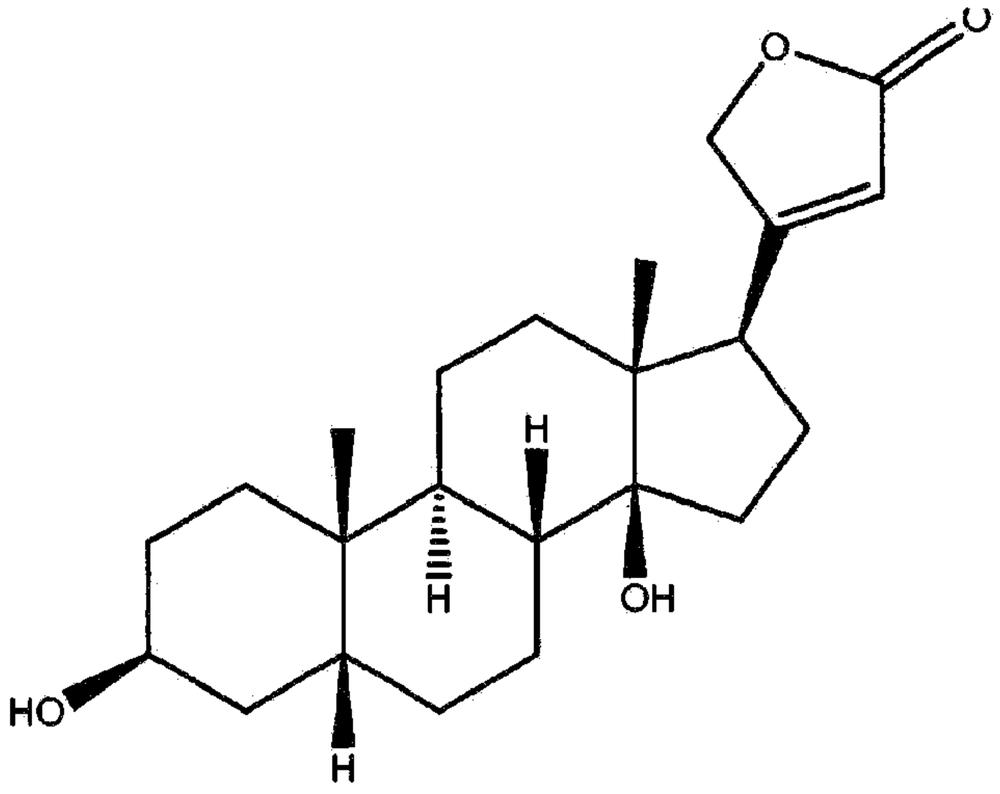
;

and

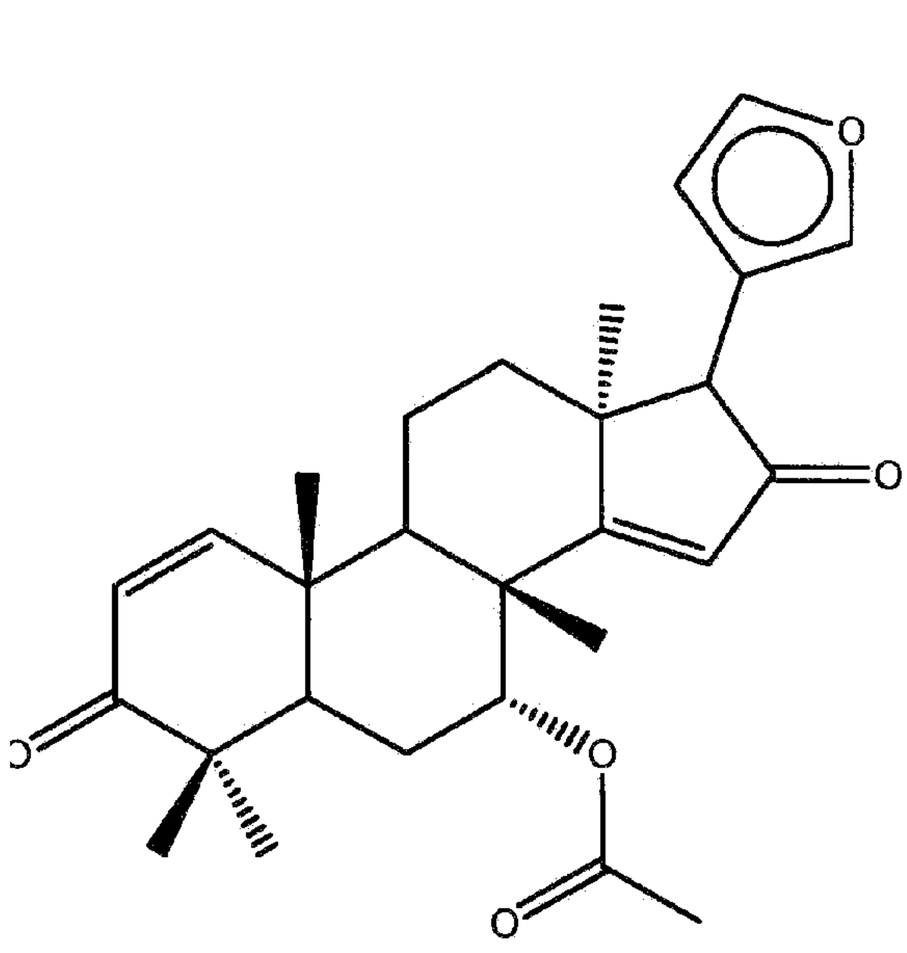
G is CH_2 or C=O.

Compound (73) falls within structure (Q) and falls within the claims.

[0064] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:

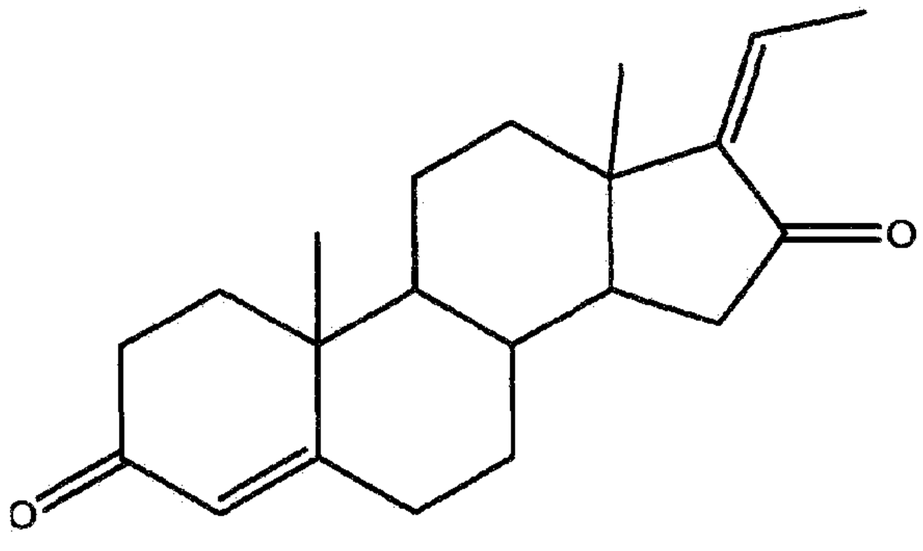


(73),



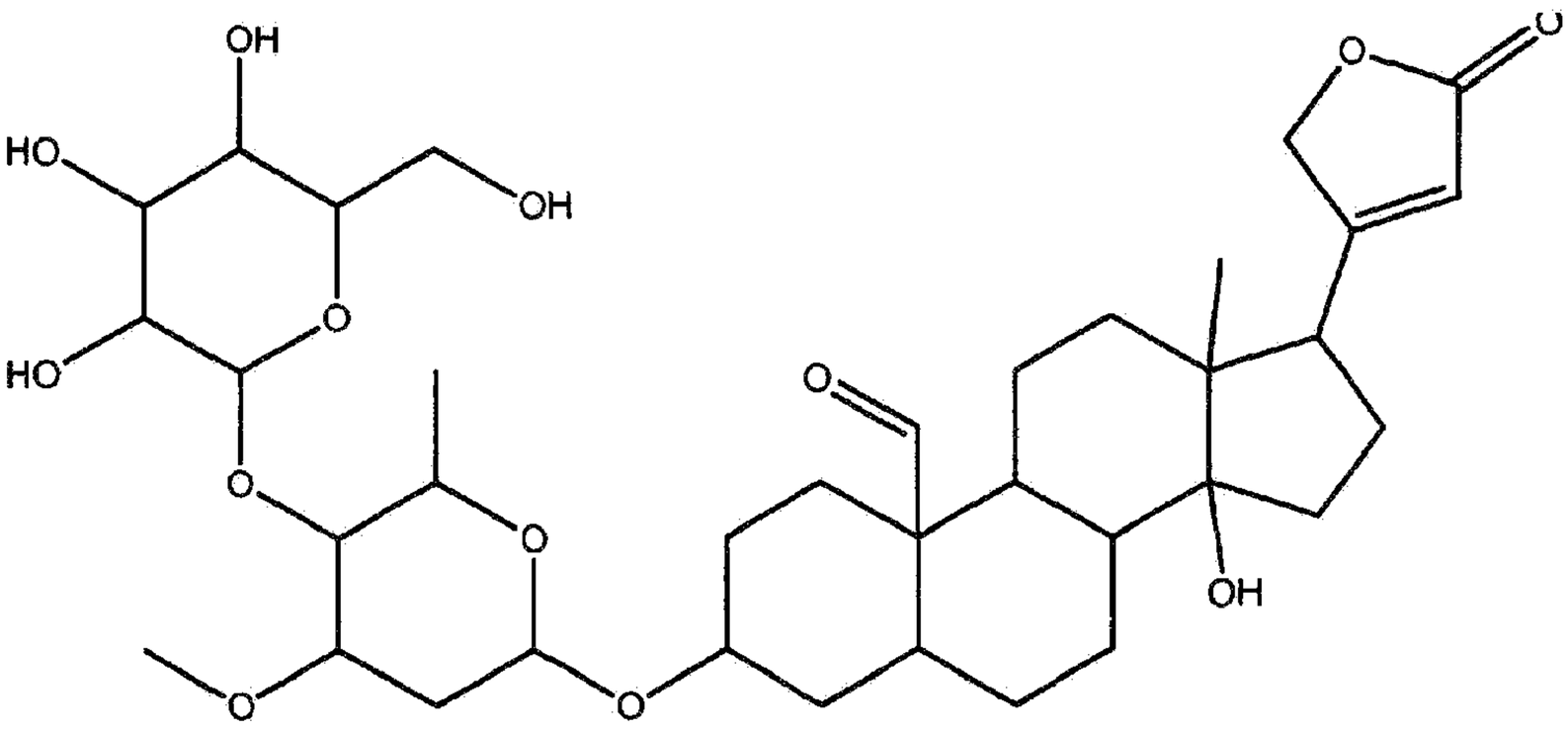
(74),*

* not within the claims



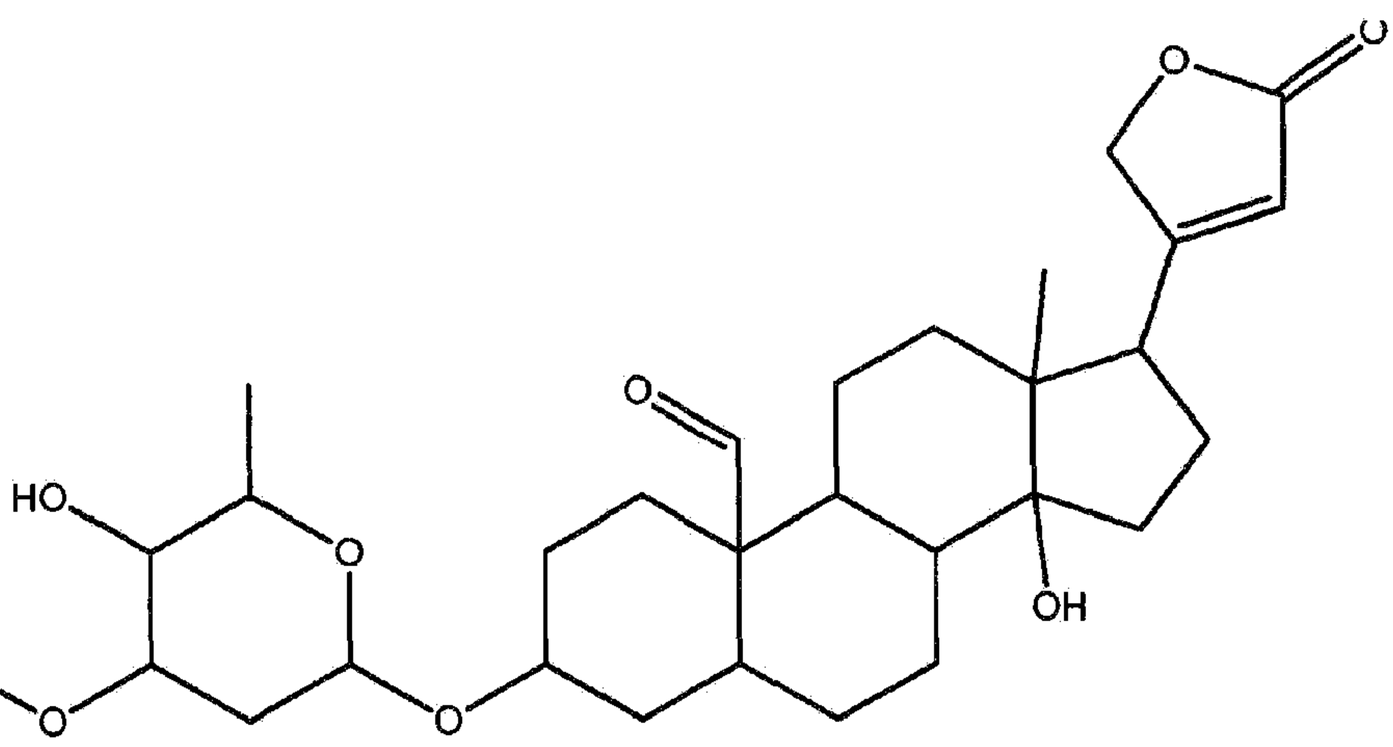
(75),

* not within the claims



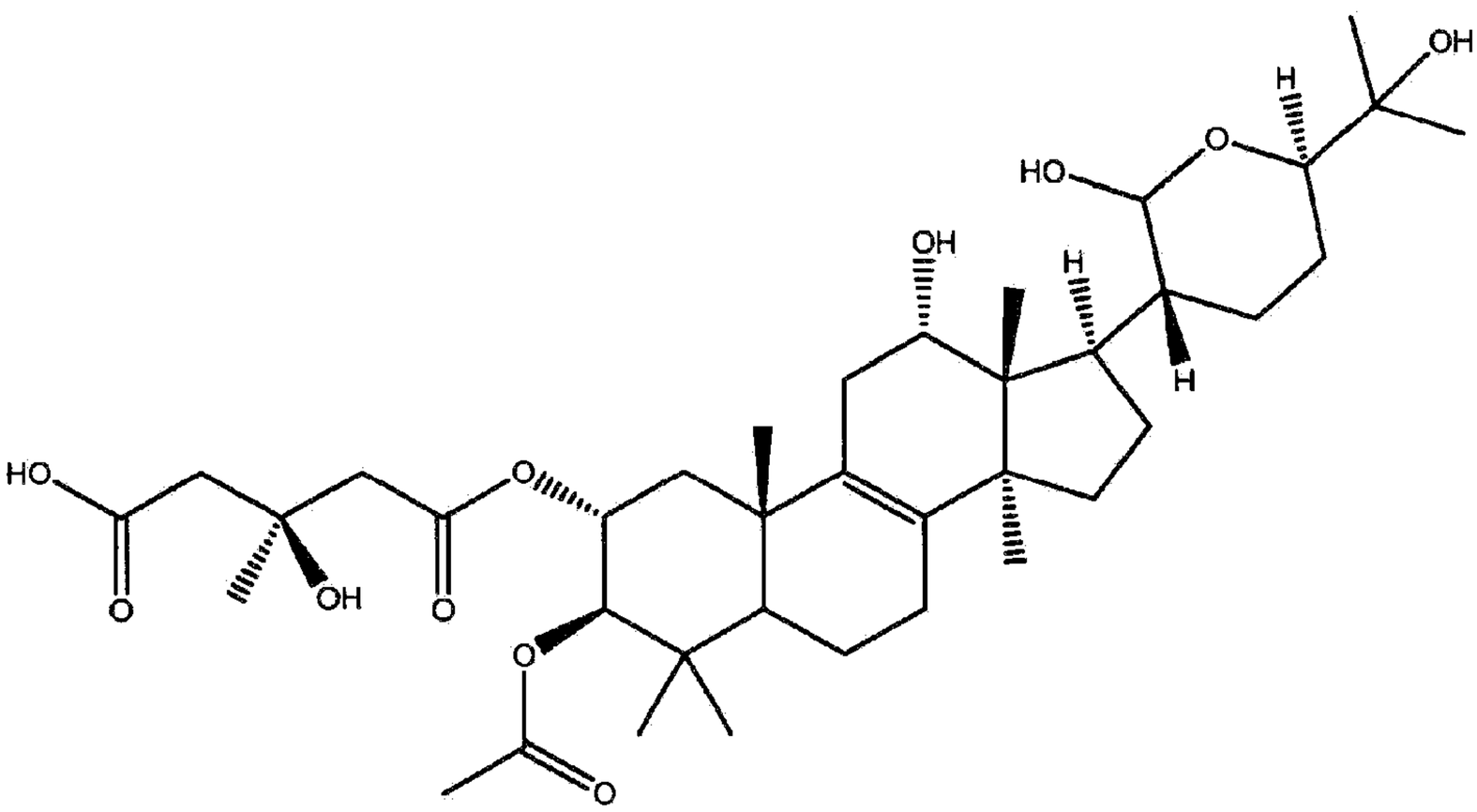
(76),'

* not within the claims



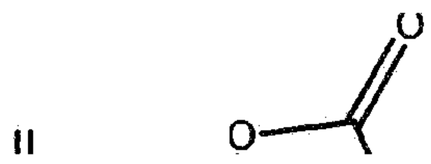
(77),'

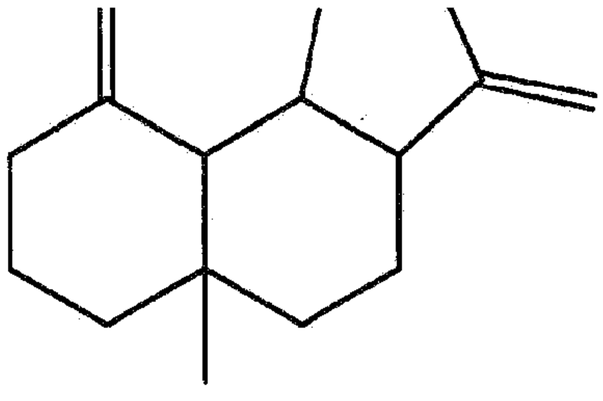
* not within the claims



(78),

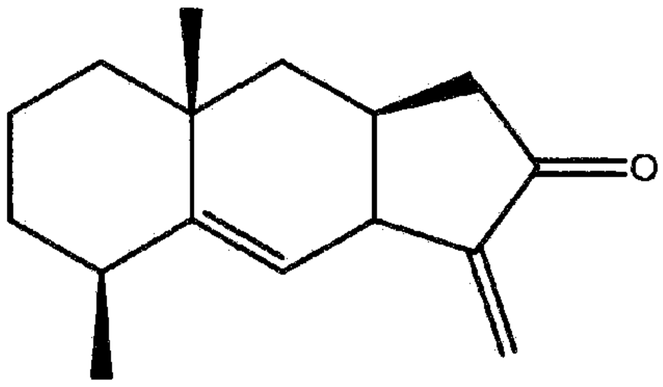
* not within the claims





(79),

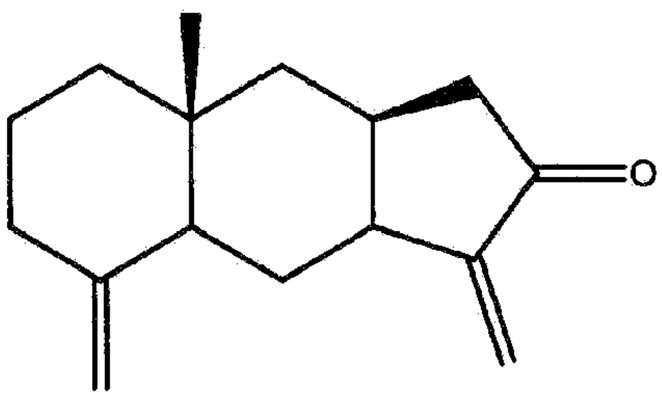
* not within the claims



(80a),

* not within the claims

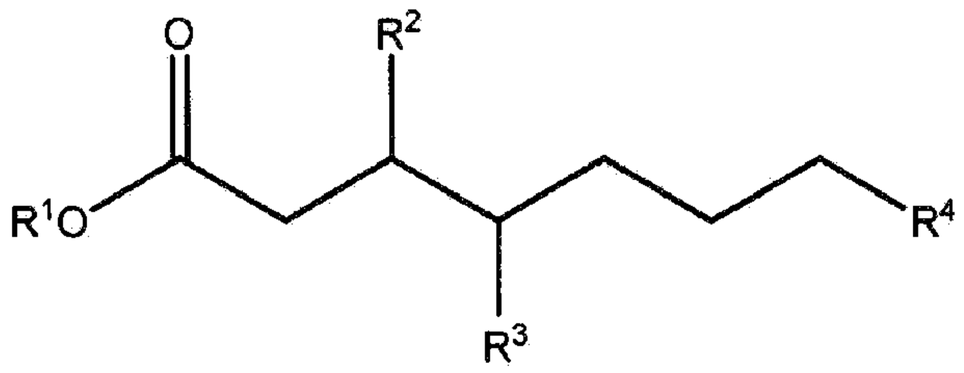
or



(80b).

* not within the claims

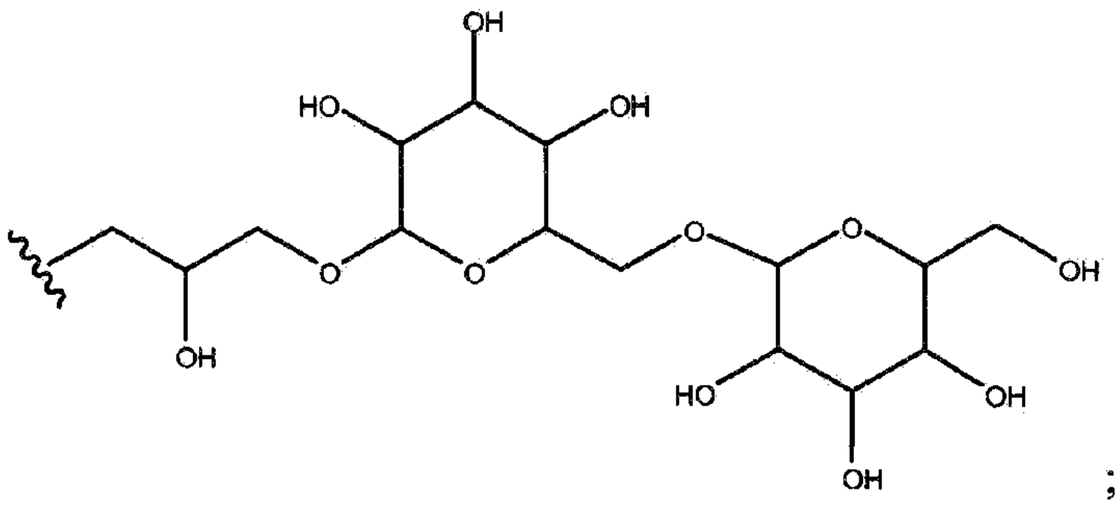
[0065] In embodiments a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims):



(R1),

where

R^1 is H or

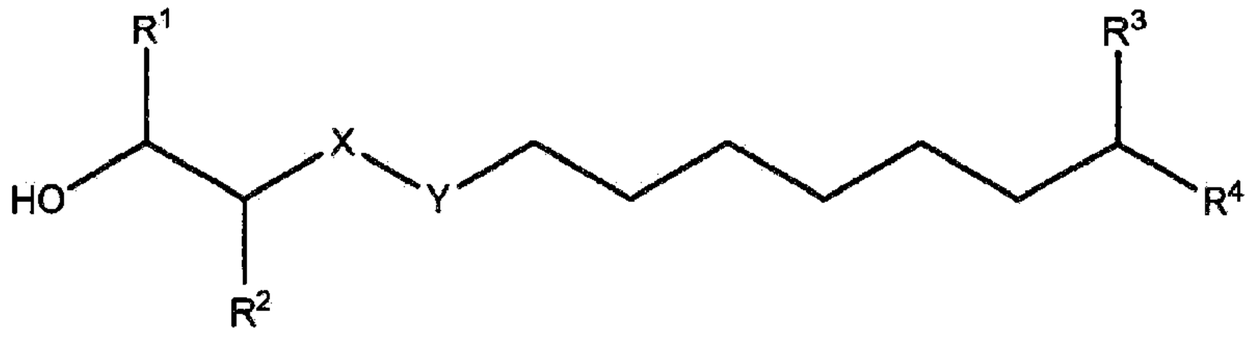


;

R^2 and R^3 are independently H, OH, and COOH; and

R^4 is C_3-C_{12} saturated or unsaturated alkyl optional substituted with hydroxyl.

[0066] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims):



(R2),

where

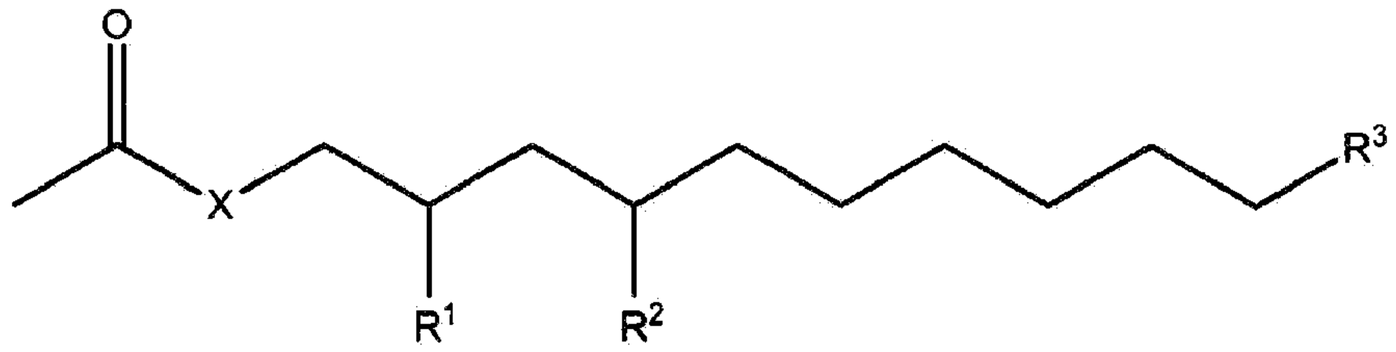
R^1, R^2 and R^3 are independently H or OH;

X is O or CHOH;

Y is C=O or CH_2; and

R^4 is C_3-C_{12} unsaturated alkyl.

[0067] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:



(R3),

where

X is O or NH;

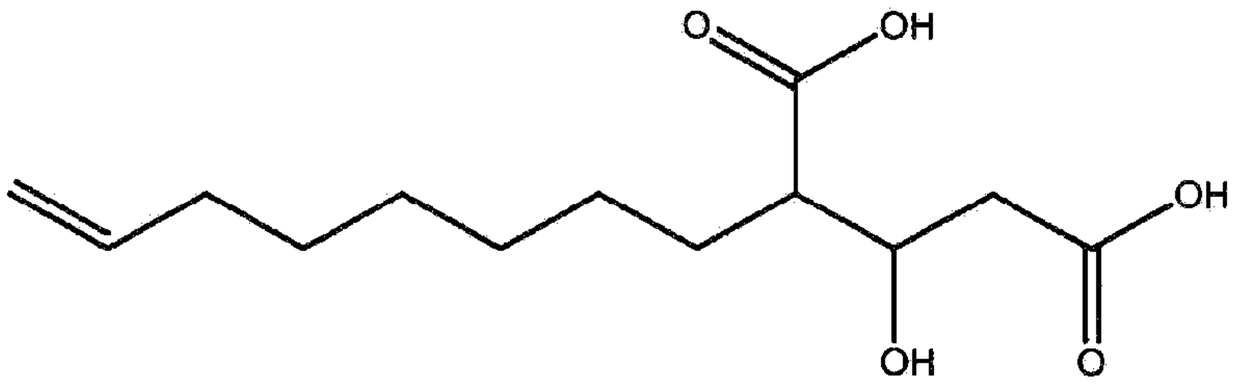
R^1 is H or OH;

R^2 is H or $OCOCH_3$; and

R^3 is H or C_1-C_6 saturated or unsaturated alkyl.

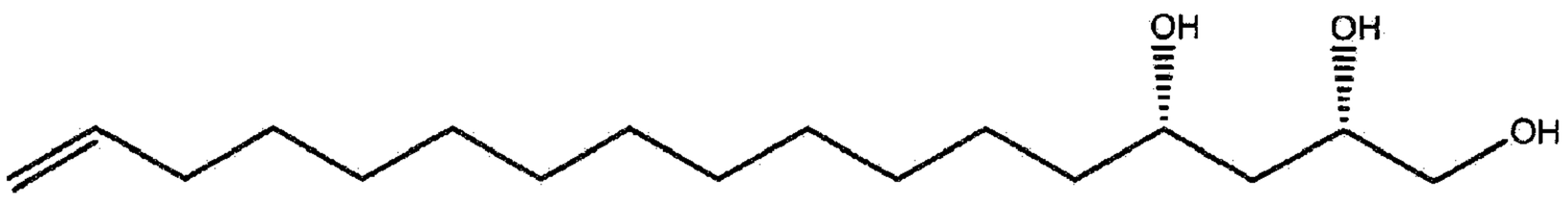
Compounds (83) and (84) fall within structure (R3) and fall within the claims.

[0068] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure:

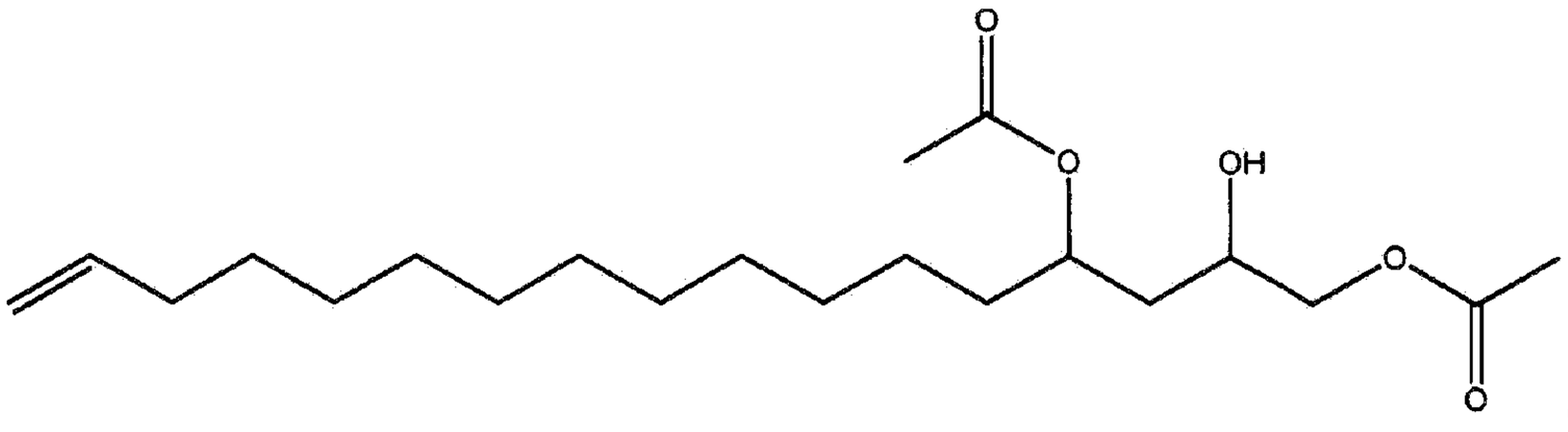


(81),

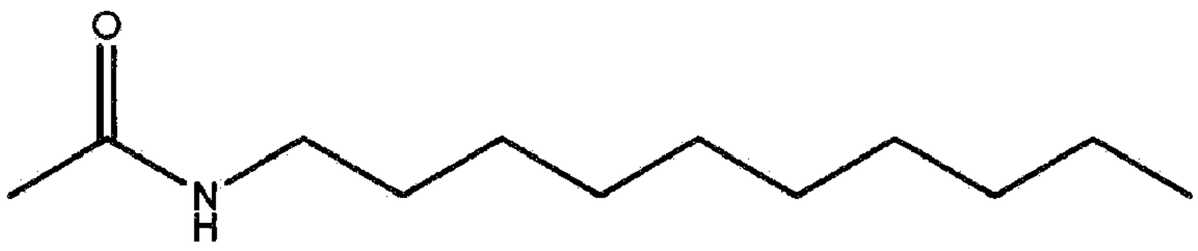
* not within the claims



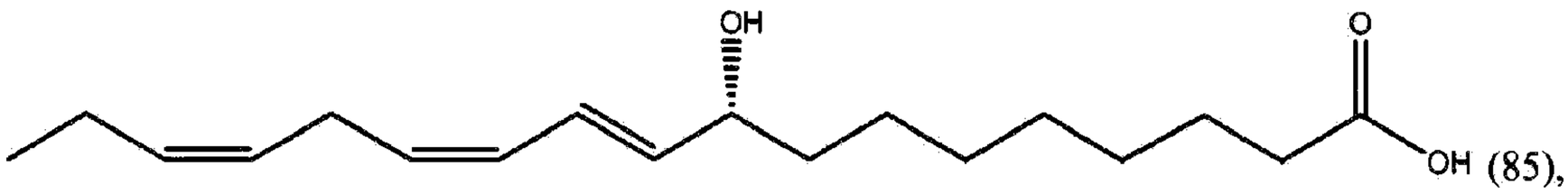
(82),



(83),

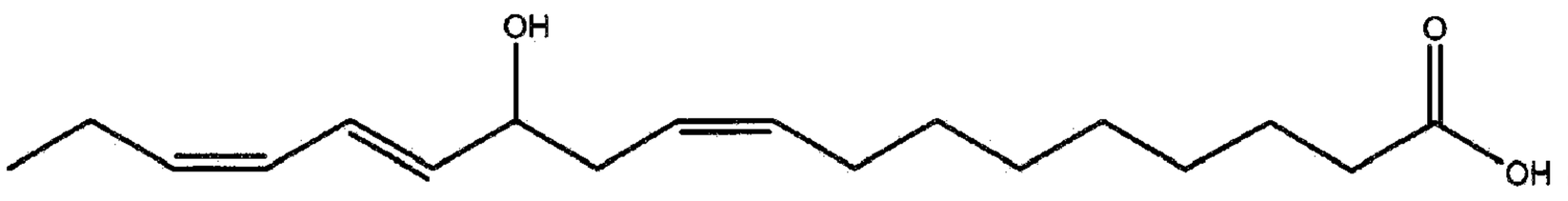


(84),



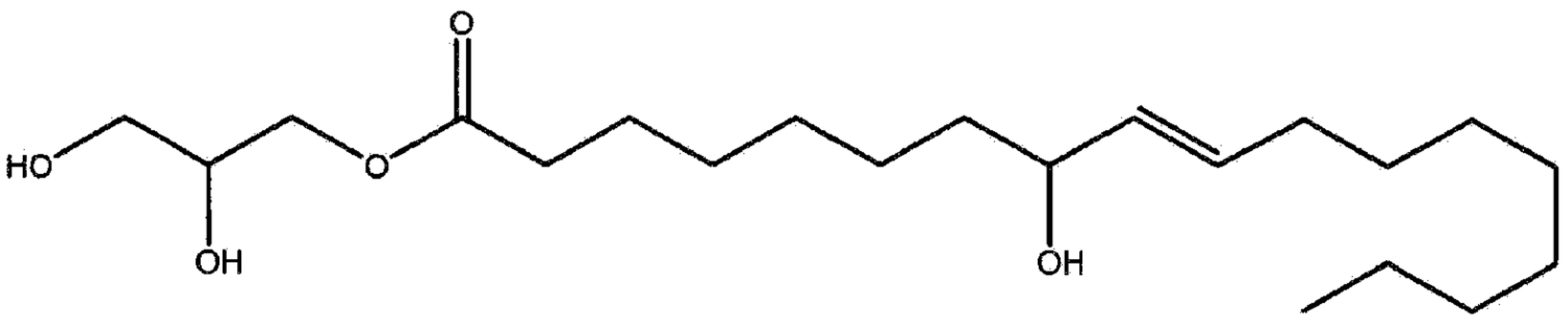
(85),

* not within the claims



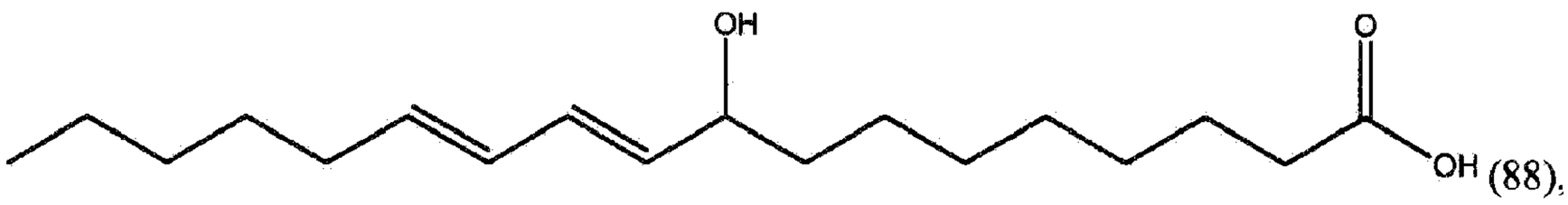
(86),

* not within the claims



(87),

* not within the claims



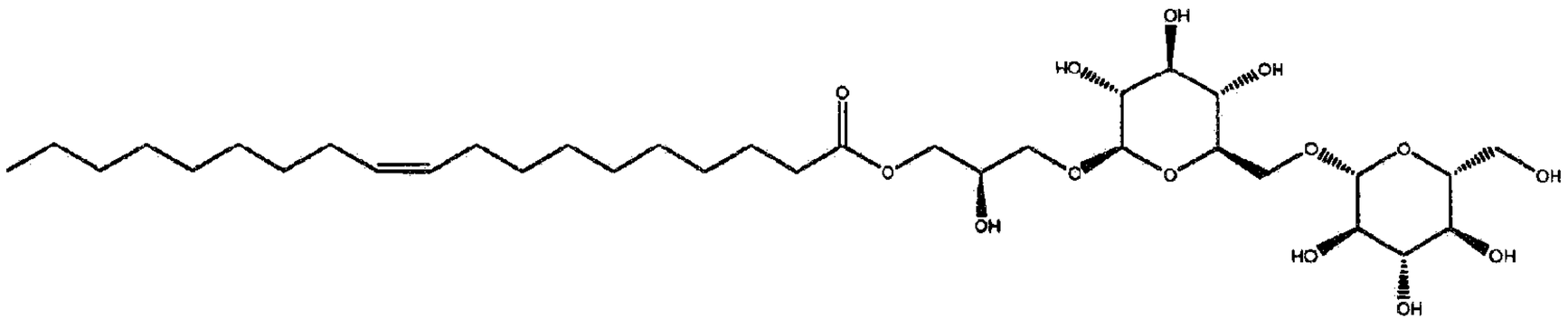
(88),

* not within the claims

(89),

* not within the claims

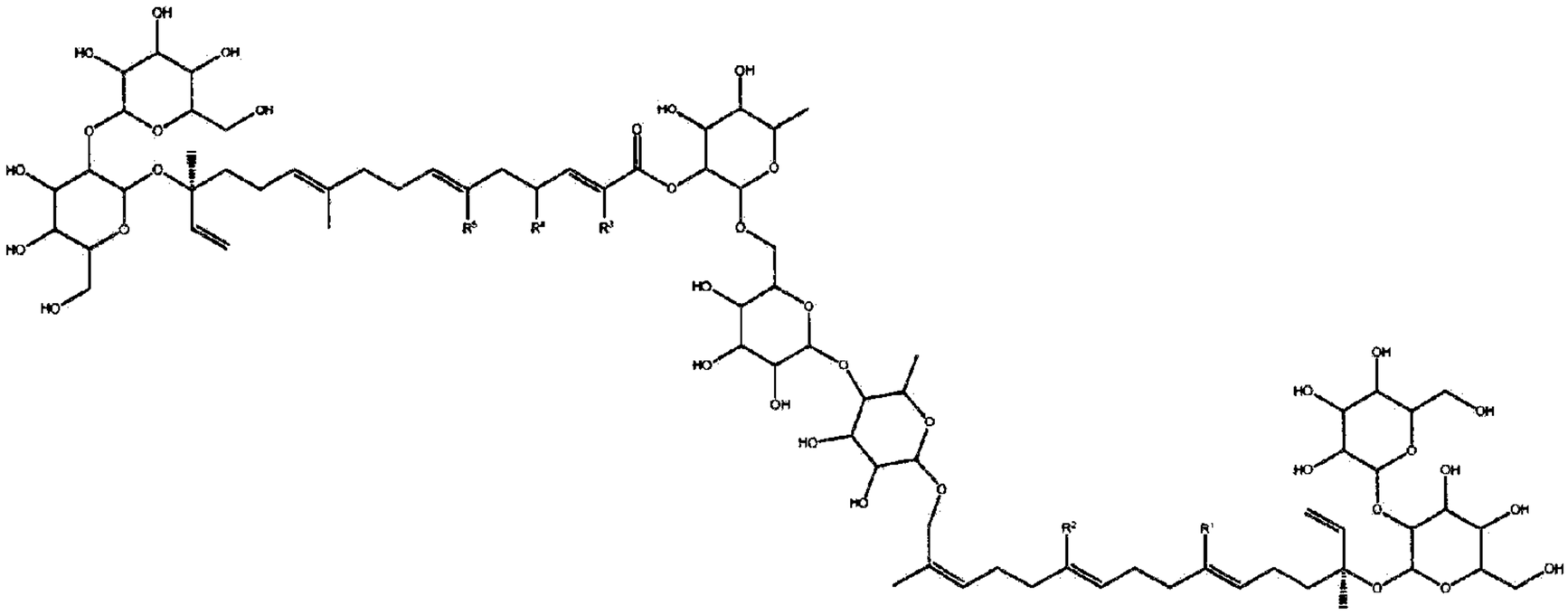
or



(90).

* not within the claims

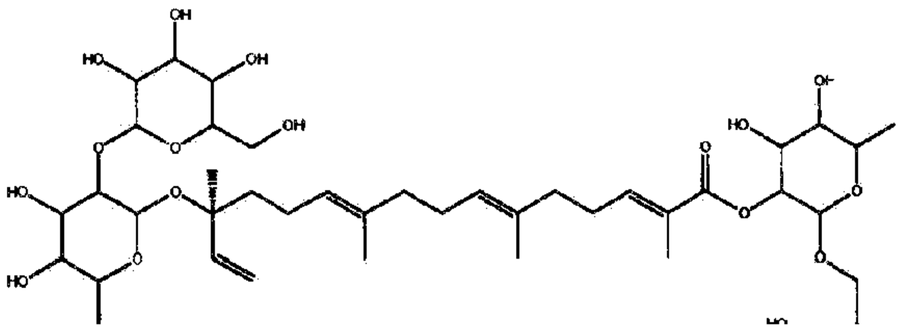
[0069] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims):

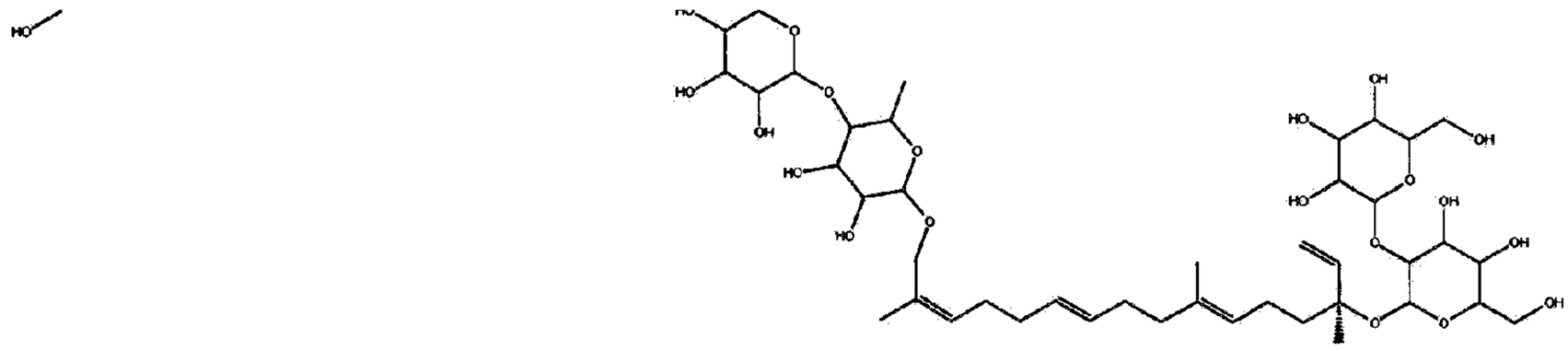


(S),

where R^1, R^2, R^3, R^4 and R^5 are each independently H, CH_3 or OH.

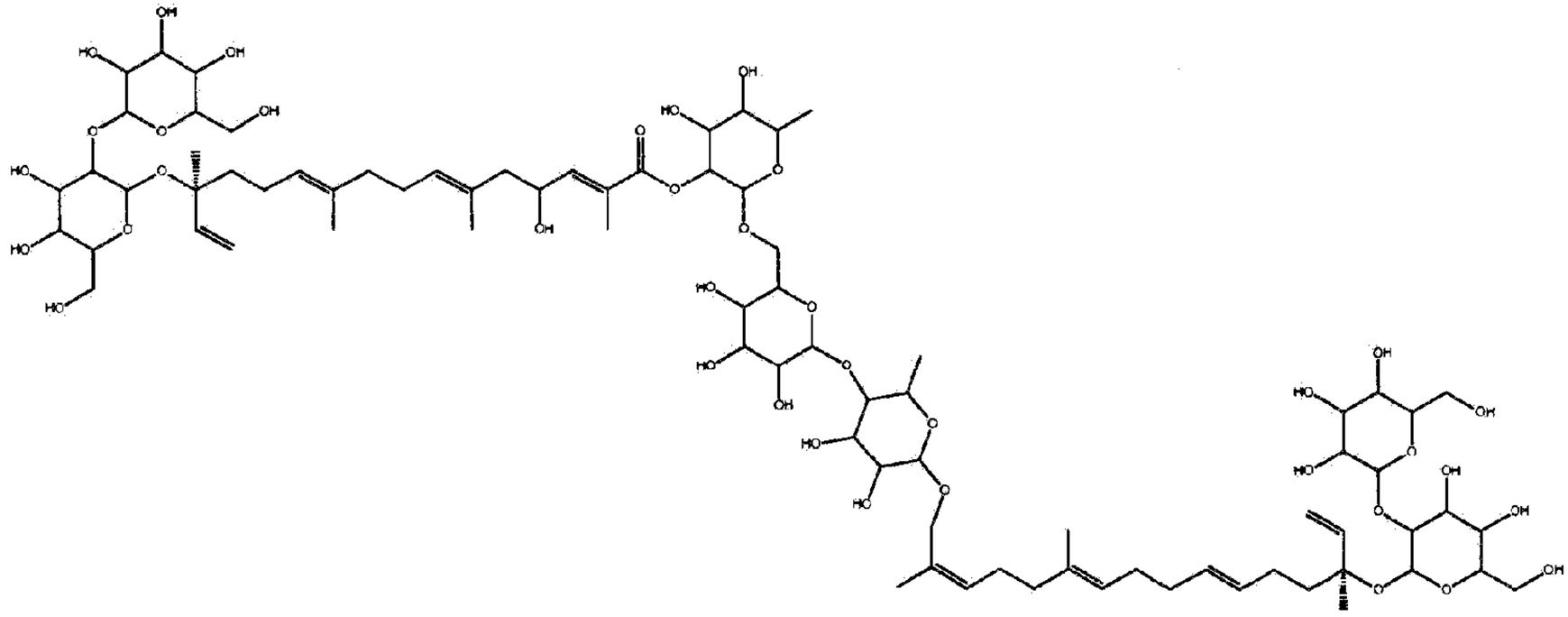
[0070] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims):





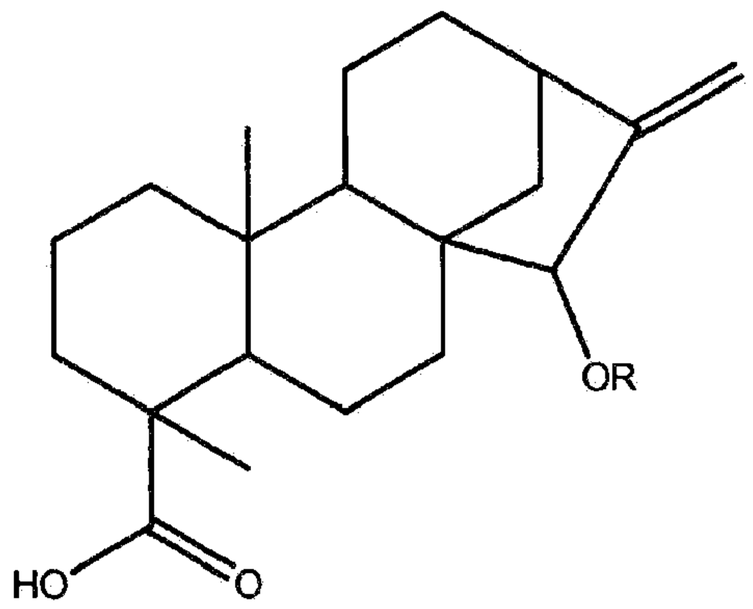
(91),

or

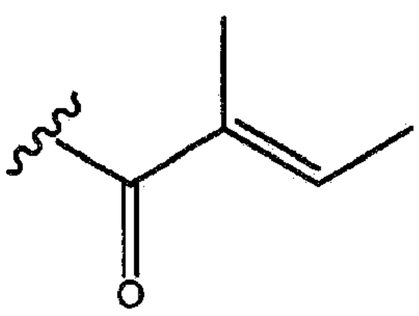


(92).

[0071] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims): where R is H, $COCH_3$ or

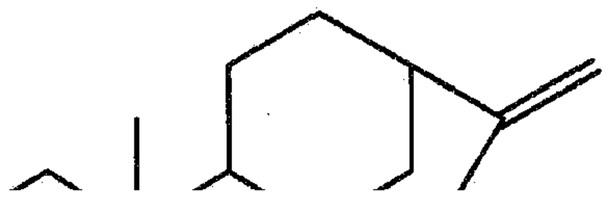


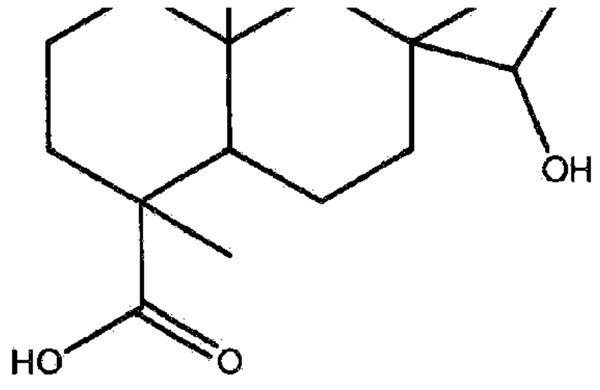
(T),



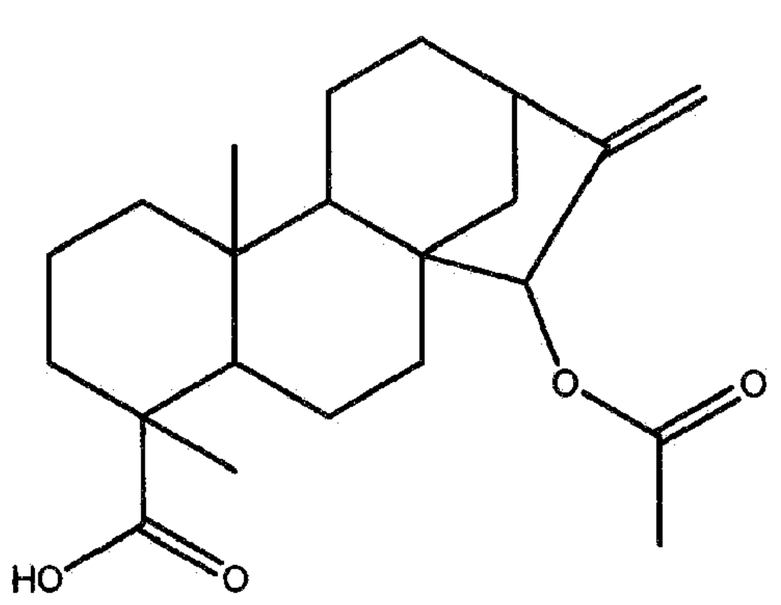
.

[0072] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims):



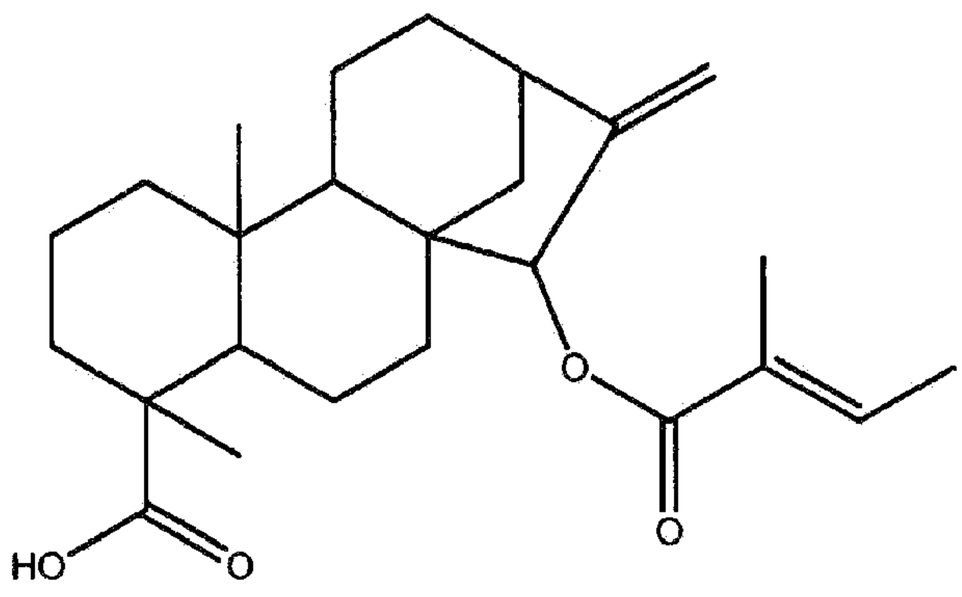


(93),



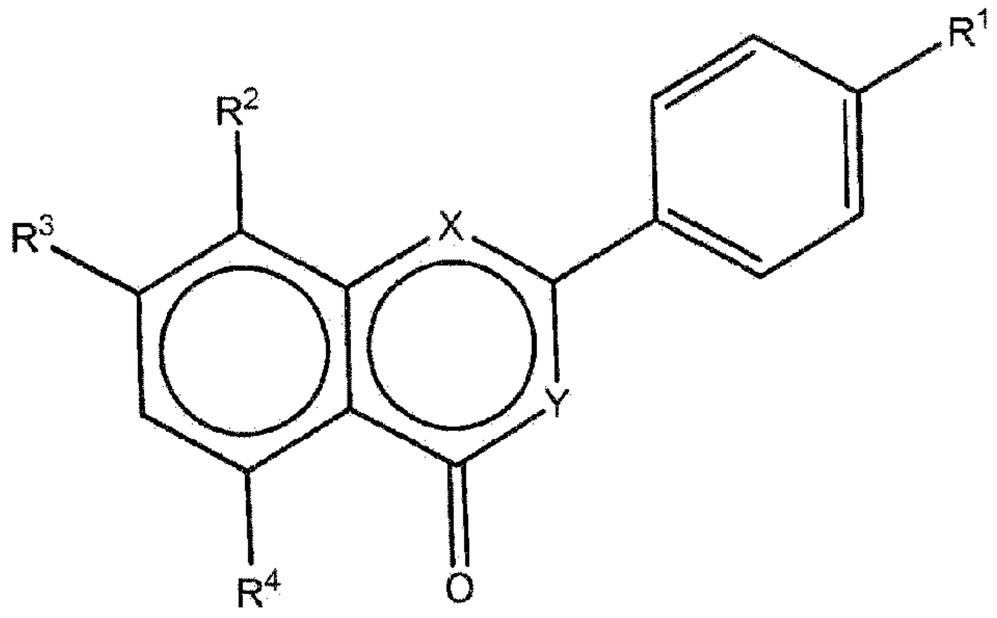
(94),

or



(95).

[0073] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims):

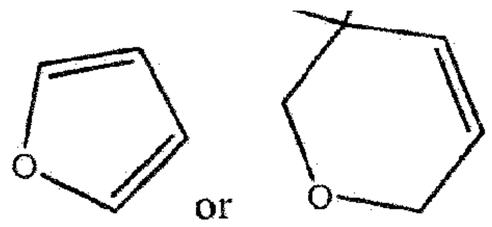


(U),

where:

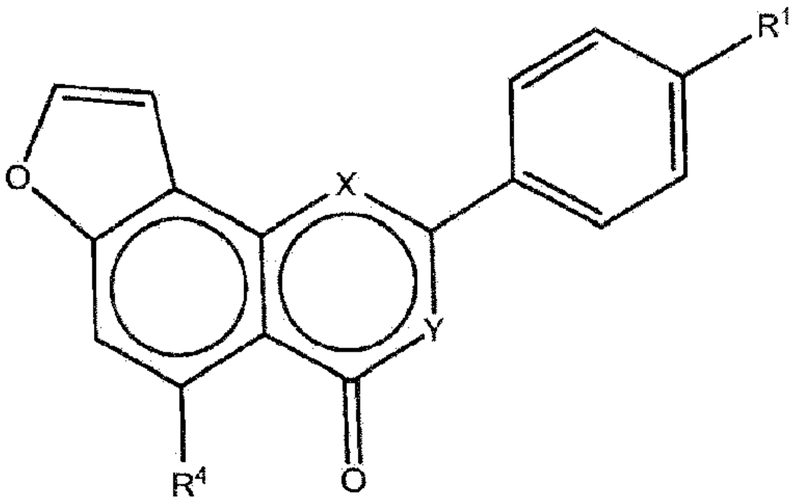
R^1 is H, OH, or C_1-C_3 alkoxy;

R^2 is H or R^2 and R^3 together form



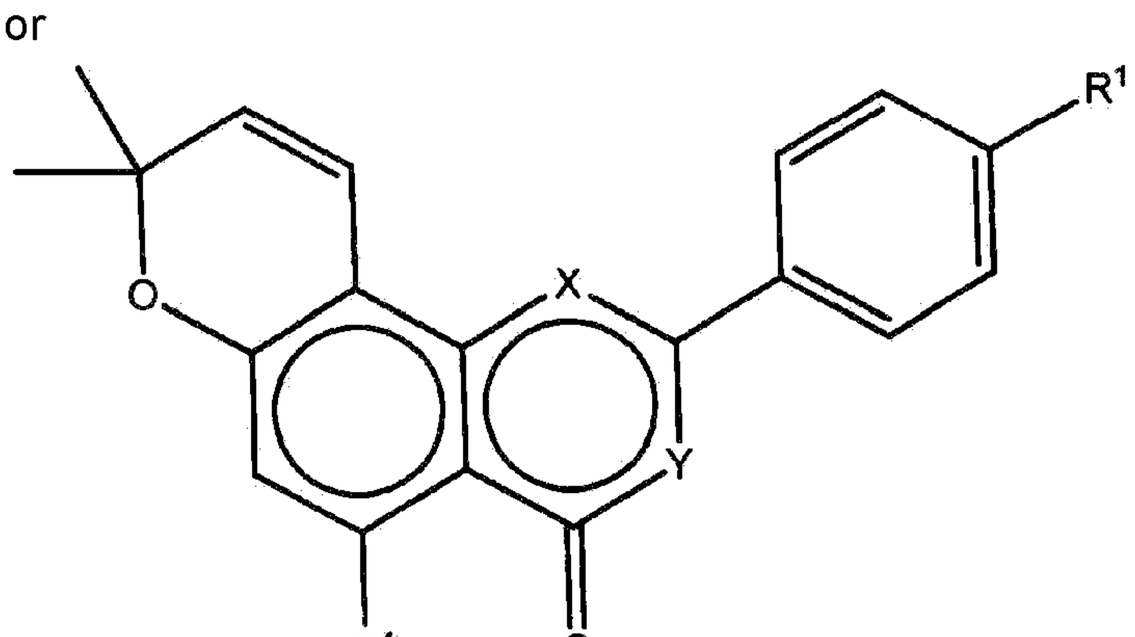
or

to form a compound of the following structure



(U')

or



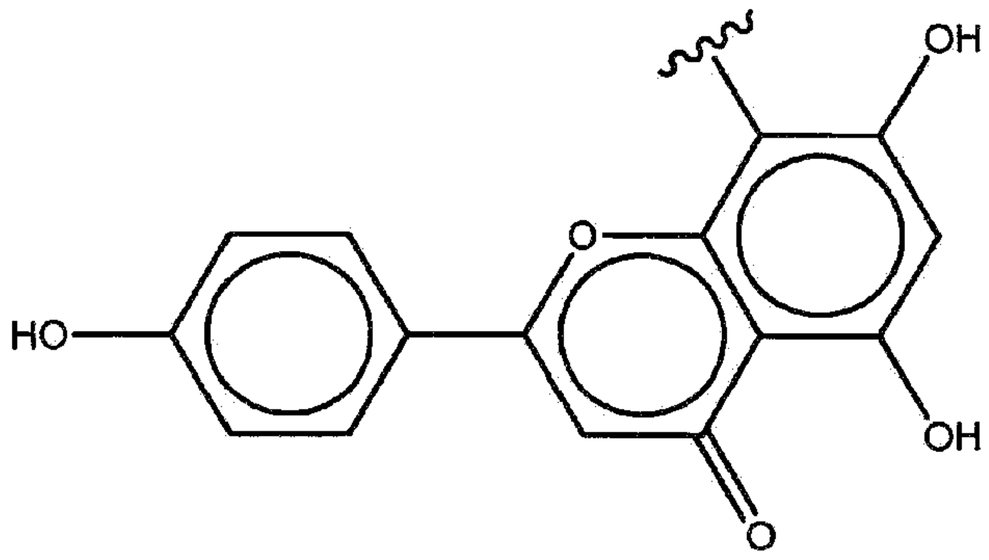
(U");

R^3 is H, OH or R^2 and R^3 together form a ring structure as indicated above;

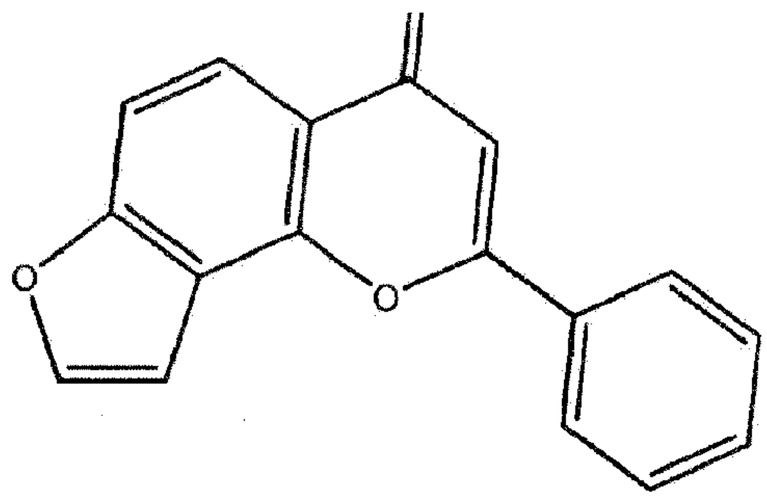
R^4 is H, OH, or C_1-C_3 alkoxy;

X is O or CH; and

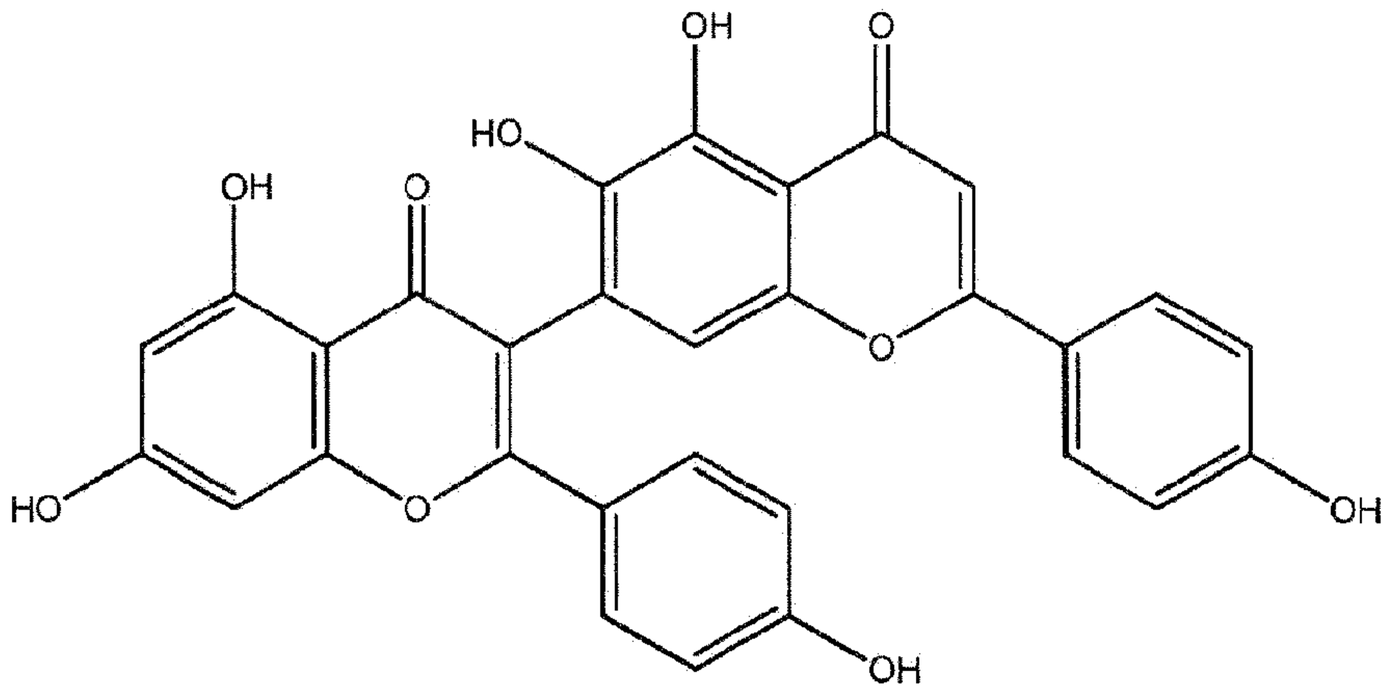
Y is O or CR^5 where R^5 is H or



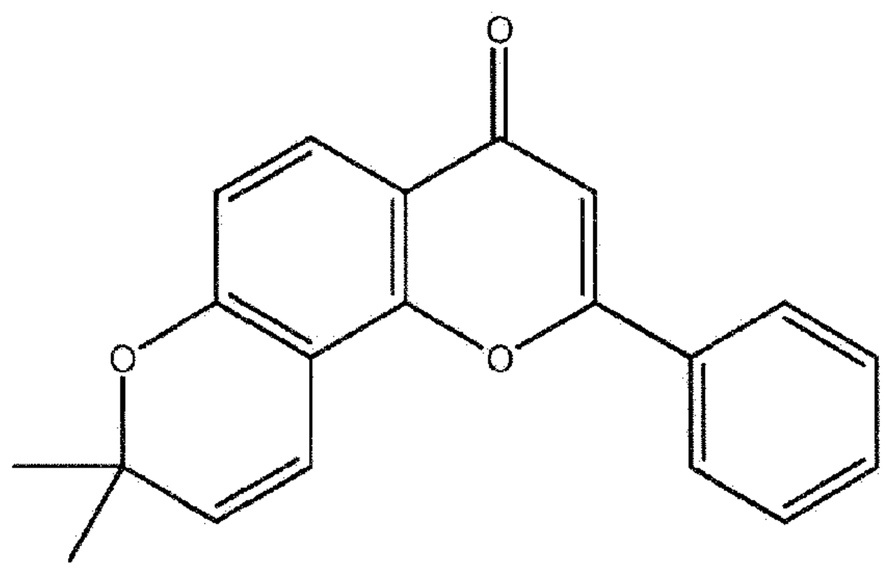
[0074] In embodiments, a bioactive, taste modulating, or salty taste modulating compound is a compound having the following structure (not within the claims):



(96),

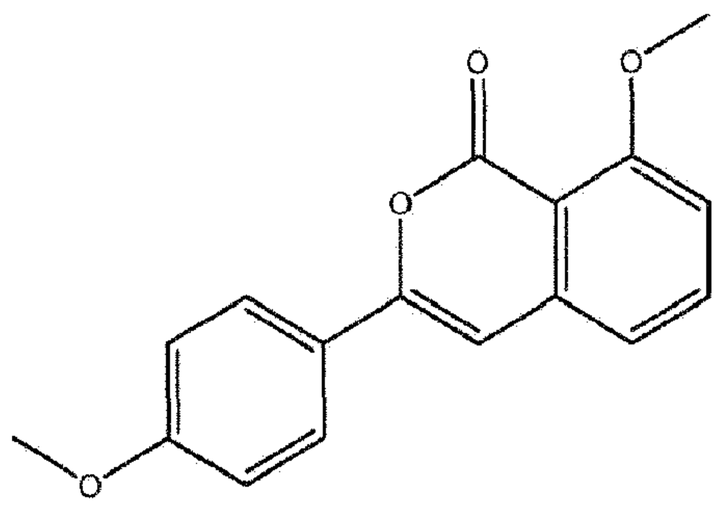


(97),



(98),

or



(99).

[0075] As can be seen from the structures of the compounds provided above, many of the compounds have structural similarities. Accordingly, it is believed that structural derivatives of the specific compounds presented above would also have the ability to elicit the perception of saltiness or enhance saltiness. Combinations of the compounds could also serve to elicit the perception of saltiness or enhance saltiness. In addition or alternatively, one or more of the compounds may elicit the perception of other simple or complex flavors, other than or in

addition to saltiness.

[0076] Many of the structural similarities between the compounds are reflected in the compounds of Formulas **A, B1, B2, C, D, E, F1, F2, G, H, I, J1, J2, K, L, M, N, O, P1, P2, Q, R1, R2, R3, S, T,** and **U,** as well as subclasses thereof, presented above. It will be further understood, based on the compounds identified herein, that one or more of gingereols, alkly substituted phenols, acridone alcaloids, labdanes, primaranes, saponines, neolignans, pentacyclic triterpenes, 2,2'-cyclolignans, dibenzylbutane lignans, bicyclic triterpenes, phloroglucines, carylophyllenes, beta-carbolines, limnoids, cumarines, cardanolide steroids, fatty acids, and derivatives may be candidates for taste modulating compounds. It will be further understood that other structural similarities of the compounds presented herein may be exploited to develop taste modulating compounds.

[0077] By way of example, many of the compounds presented herein have unsaturated carbon chains of at least 11 carbons with attached hydroxyl groups and may be amphiphilic, with hydrophobic head potions and hydrophobic tails. Other compounds having, for example C5-C20 alkane or alkene tails may similarly elicit or enhance saltiness. Similarly, other compounds with differently substituted carboxyl or hydroxyl groups may also elicit or enhance the perception of saltiness.

[0078] Many compounds presented herein have large numbers of cyclic groups having a central portion that may be hydrophobic and peripheral regions that may be hydrophilic. More specifically, some compounds include pentacyclohexane with hydroxyl groups, attached sugars and at least on ester linkage. Substitution of the central hydrophobic ring structure with, for example, C5-C20 hydrophobic alkyl or alkene groups, may result in compounds that may elicit or enhance saltiness. Alternative substitution of hydrodroxyl groups at the peripheral regions or substitution with carboxylic groups may also result in compounds that elicit or enhance the perception of saltiness.

[0079] Many of the compounds presented above have one or more aromatic ring structures, with some being substituted and some being unsubstituted. Similar substitution or unsubstitution of such compounds may result in compounds that enhance or elicit saltiness.

[0080] A plurality of compounds presented herein include saturated carbon chains of at least 9 carbons and one oxygen containing group such as hydroxyl, carbonyl, carboxyl, or ester. Other compounds having unsaturated carbon chains of, for example, 5 to 15 carbons and an oxygen group may have similar effects with regard to salty taste.

[0081] Many compounds presented herein have at least on phenol group with an ether group and a carbon side chain comprising at least seven carbons. Other similar compounds may have similar effects with regard to salty taste.

[0082] A number of compounds presented herein have a benzyl heterocyclic furan with various attached groups containing unsaturated carbon linkages and at least one carbonyl group.

Other similar compounds may have similar effects with regard to salty taste.

[0083] A plurality of compounds presented above contain a cyclopentaphenthrene group. Other compounds having a cyclopentaphenthrene and similar substituents may have similar effects with regard to salty taste.

[0084] A number of the compounds presented herein include a benzopyranone group. Other compounds having a benzopyranone and similar substituents may have similar effects with regard to salty taste.

[0085] Some compounds presented above have unsubstituted carbon chain with a minimum of 13 carbons and at least one carbonyl group. Other similar compounds may have similar effects with regard to salty taste.

[0086] A plurality of compounds presented herein have a methoxymethyltetrahydrobenzocyclooctabenzo-dioxole or -annulene group. Other compounds having such groups may have similar effects with regard to salty taste.

[0087] A number of compounds presented above have tetracyclohexane with an attached ester or carbonyl moiety. Other similar compounds may have similar effects regard to salty taste.

[0088] It will be understood that derivations of the compounds discussed above are provided for purposes of example and that other derivatives or derivations may be made based on structural similarities between the various compounds, resulting in compounds that have elicit or enhance perception of saltiness.

[0089] Many of the identified compounds were tested by tasters and rated for perception of saltiness in combination with reduced amounts of sodium chloride and were assigned a rating (DAP score) for saltiness. Briefly, each individual tested compound was placed in water and in sodium solution to test saltiness and saltiness enhancement potential. Tests in water were executed in a compound concentration of 10 ppm. Tests in sodium solution were executed in compound concentrations of 0.1, 1 and 10 ppm. Two control sodium solutions with known organoleptic salt intensities were provided as references for each test. The test for individual compounds was also conducted using simple broth instead of sodium solution. A number of compound combinations identified from the Na-solution DAP test were used for the broth DAP test. Tests were executed with a trained panel of 9-12 assessors. For Na-solution DAP tests, a DAP score of greater than 3.1 indicates saltiness or salt enhancement. The DAP score can be correlated with a sodium reduction potential by subtracting 3.1 from the DAP score. For example, a DAP score of 4.0 would result in a 9% sodium reduction potential ((4.0 - 3.1 = 0.9*10 = 9%), which means that 9% less sodium may be present in a food product having the salty compound relative to a substantially similar food product that does not have the salty compound while producing a similar saltiness. For broth DAP tests, a DAP score of greater than 7.6 indicates saltiness or salt enhancement. The DAP score can be correlated with a

sodium reduction potential by subtracting 7.6 from the DAP score. For example, a DAP score of 8.5 would result in a 9% sodium reduction potential ((8.5 - 7.6 = 0.9*10 = 9%), which means that 9% less sodium may be present in a food product having the salty compound relative to a substantially similar food product that does not have the salty compound while producing a similar saltiness.

[0090] A summary of the compounds and the DAP scores are provided below in **Table 1.**

Table 1. Activity of identified compounds in Na-Solution and in simple broth

Compound	DAP in Na-Sol.	DAP in Broth
1 *	3.6	7.8
2 *	3.5	7.8
3 *	4.1	8.8
4 *	3.5	None
5 *	3.6	None
6 *	3.8	None
7 *	3.7	None
8 *	4	None
9 *	3.8	None
10	3.9	7.9
11 *	2.6	8.1
12	4	7.6
13	3.8	7.9
14 *	3.6	None
15 *	3.5	8.1
16	3.3	8.0
17 *	3.6	8.2
18 *	3.8	8.1
19 *	None	None
20 *	4	None
21 *	4	None
22 *	None	None
23 *	2.9	8.3
24 *	None	None
25 *	3.9	None
26 *	3.4	None
27 *	3.4	None
28 *	3.6	None

Compound	DAP in Na-Sol.	DAP in Broth
29	3.5	8.0
30 *	3.1	None
31 *	3.2	None
32 *	3.5	8.1
33	3.4	7.7
34 *	3.9	7.7
35 *	3.7	8.1
36	3.9	8.2
37	3.7	8.1
38 *	3.9	8.1
39 *	None	None
40 *	3.5	7.8
41	3.9	7.5
42 *	3.1	8.1
43	3.7	8.0
44	3.8	8.6
45	3.5	8.2
46 *	3.6	7.8
47 *	None	None
48	3.7	7.8
49 *	3.6	8.2
50 *	4	None
51 *	None	None
52 *	3.6	None
53	3.7	8.5
54 *	3.4	8.1
55 *	None	None
56	4	7.7
57 *	3.1	None
58 *	3.3	8.0
59 *	3.3	7.9
60 *	3.8	8.1
61 *	3.6	None
62	3.9	78.0
63 *	3.5	8.0

Compound	DAP in Na-Sol.	DAP in Broth
64 *	3.7	7.8
65 *	3.3	7.9
66	3.2	7.8
67 *	None	None
68 *	None	None
69 *	None	None
70 *	None	None
71 *	None	None
72 *	None	None
73	3.5	8.0
74 *	3.2	7.7
75 *	3.6	None
76 *	3.2	8.0
77 *	3.4	8.1
78 *	None	None
79 *	None	None
80a [1] *	3.9	None
80b [1] *	3.9	None
81 *	3.2	7.8
82	3.8	8.3
83	4.2	8.1
84	3.8	8.1
85 *	2.9	None
86 *	3.9	8.0
87 *	3.9	8.0
88 *	3.2	8.0
89 *	3.7	7.6
90 *	None	None
91 *	3.7	None
92 *	4	None
93 *	None	None
94 *	4.2	None
95 *	None	None
96 *	None	None

Compound	DAP in Na-Sol.	DAP in Broth
97 *	None	None
98 *	None	None
99 *	4.1	None
1) Compounds 80a and 80b may exist as separate compounds or may be equilibrium, spontaneously shifting from one form to the other. * not within the claims		

[0091] In **Table 1** above, "None," with regard to a DAP score, means the compound was not taste tested.

[0092] DAP score testing results for various pairs of compounds are presented in **FIG. 1** (sodium solution) and **FIG. 2** (broth). Certain combinations were tested twice. For these combinations, two DAP scores are shown in the tables presented in **FIGS 1-2.** As shown in the results presented in **FIGS. 1-2,** certain combinations of compounds can enhance the perception of saltiness. Some combinations resulted in DAP scores as high as 4.5 in some tests. See, for example, the combination of compound **83** and **13** in **FIG. 1** (sodium solution) and the combination of compound **12** and **18** in **FIG. 2** (broth). Such DAP scores may result in a sodium reduction potential of about 14%. The combinations tested in **FIGS. 1-2** are representative of the combinations that may be used in a food product to enhance the perception of saltiness or reduce sodium content. It will be understood that any other suitable combination of compounds may be employed.

[0093] Additional testing of combinations of pairs of compounds was performed in sodium solution. The DAP scores from this additional testing is shown below in **Table 2.**

Table 2: Activity of a combination of bioactive compounds in sodium solution

	Compound 66: (0.1ppm)	Compound 29: (10ppm)	Compound 16: (1ppm)	Compound 33: (1ppm)	Compound 73: (1ppm)
Compound 83: (1 ppm)	3.7	4.0	3.8	3.6	4.0
Compound 10: (1 ppm)	3.3	3.7	3.8	2.9	3.6
Compound 45: (10 ppm)	3.2	3.3	3.8	3.7	4.2

[0094] In addition, more than two bioactive, taste modulating or salty taste modulating

compounds described herein may be included in a food product. By way of example, **Table 3** below shows DAP scores obtained from testing sodium solutions and chicken broth containing a combination of compounds **12, 13** and **83.** As shown in **Table 3,** such a combination resulted in a DAP score of 5.3 when tested in a sodium solution. Accordingly, such a combination may result in a sodium reduction potential of about 22%. Of course, other suitable combinations of three or more compounds may be used or included in a food product to enhance the perception of saltiness or to reduce sodium content.

Table 3: Activity of a combination of bioactive compounds in sodium solution and broth

Compound Conc.		In Na Solution	In Broth
12	1 ppm	5.3	8.1
13	10 ppm		
83	1 ppm		

[0095] Some illustrative examples of combinations of compounds that may produce desired or beneficial effect, for example when incorporated in a food product, include combinations that include at least one compound selected from the group consisting of **3, 10, 12, 13, 16, 18, 29, 33, 36, 37, 41, 43, 44, 45, 48, 53, 56, 62, 66, 73, 82, 83,** and **84.** Another illustrative example is a combination that includes at least one compound selected from the group consisting of compounds **10, 12, 13, 18, 36, 45, 56, 82,** and **83.** Yet another illustrative example is a combination that includes compounds **12, 13** and **83.** Of course, any other suitable or desirable combination may be used.

[0096] DAP scores for combinations of three different compounds in broth are shown in **Table 4** below.

Table 4: Activity of a combination of bioactive compounds in broth

Compound (concentration)	**DAP score**
3 (0.1 ppm)	7.8
36 (0.1 ppm)	
44 (10 ppm)	
3 (0.1 ppm)	7.7
36 (0.1 ppm)	
53 (1 ppm)	
3 (0.1 ppm)	7.9
36 (0.1 ppm)	
18 (10 ppm)	
13 (10 ppm)	8.1
84 (1ppm)	

Compound (concentration)	DAP score
44 (10 ppm)	
13 (10 ppm)	7.9
84 (1pm)	
53 (1 ppm)	
13 (10 ppm)	8.0
84 (1ppm)	
3 (0.1 ppm)	
18 (10 ppm) **12** (1 ppm) **44** (10 ppm)	8.1
18 (10 ppm)	8.2
12 (1 ppm)	
53 (1 ppm)	
18 (10 ppm)	8.3
12 (1 ppm)	
3 (0.1 ppm)	

[0097] Natural sources of the mentioned bioactive, taste modulating or salty taste modulating compounds can be extracted by a variety of methods such as, but not exclusive to, water, solvent extractions (ethanol/water combinations), or supercritical carbon dioxide or other volatilization methods. These concentrated extracts or isolates could be stabilized physically by encapsulation, for example, or chemical reaction to non-reactive compounds such as simple sugars or small chain fatty acids. Compounds may be altered for their solubility in aqueous solutions by hybridization to larger sized molecules and additionally processed or reacted to create an impacting ingredient in either a dry or aqueous form.

[0098] In embodiments, a composition comprises a bioactive, taste modulating or salty taste modulating compound described herein. The composition may be included in a food product. In embodiments, the composition comprises one or more natural extracts. In another embodiment, the extract is selected from a plant or microbial (e.g., fungi or bacterial) source. Examples of suitable natural extracts include extracts derived from Aesculus hippocastaneum; Alchemilla xanthochlora; Angelica archangelica; Apocynum cannabinum; Azadirachta indica; Actinomycete bacteria (Strain code: 01702axxx000002); Capsicum annuum; Cimicifuga racemosa; Commiphora mukul; Embelia ribes; Evodia rutaecarpa; Ferula assa-foetida; Fungi

(Strain code: 02295fxxx000001; Strain code: 01469fxxx000005); Gleditschia australis; Kaempferia galanga; Lavandula officinalis; Marrubium vulgare; Mesua ferrea; Nephelium cuspidatum; Orthosiphon stamineus; Persea gratissima; Petroselinum stativum; Piper longum; Pithecoctenium echinatum; Podophyllum peltatum; Psidium guajava; Ricinus communis; Salvia miltiorrhiza; Schisandea chinensis; Teclea trichocarpa; Vitex agnus; Xysmalobium undulatum; Yucca gloriosa; Zanthoxylum piperitum; Zingiber officinalis and others. The composition may be in a dry or liquid form. The liquid composition may be a solution, suspension, colloidal suspension, microencapsulated suspension, emulsion, or the like, or combinations thereof. The dry composition may be a microencapsulation solid, agglomeration, or the like or combinations thereof.

[0099] In embodiments, a bioactive, taste modulating or salty taste modulating compound described herein is included in a composition comprising a carrier. The composition comprising the carrier may be incorporated into a food product. Any suitable carrier may be used. Examples of suitable carriers include propylene glycol, ethanol, water, or oil. In embodiments, the carrier is a starch, such as a starch comprising carbohydrate, a maltodextrin, a cyclodextrin or another dextrin, or a liposome. In embodiments, the carrier is an encaspulant or the carrier may comprise an embedded bioactive, taste modulating or salty taste modulating compound.

FOOD PRODUCT

[0100] In embodiments, a food product includes a bioactive, taste modulating or salty taste modulating compound described above, or derivatives thereof, or a composition that comprises a bioactive, taste modulating or salty taste modulating compound described above, or derivatives thereof. The bioactive, taste modulating, or salty taste modulating compound may be derived from a natural product, may be synthesized, or may be isolated or purified.

[0101] One or more bioactive, taste modulating or salty taste modulating compounds described above or derivatives thereof, alone or in combination, may be incorporated into a food product. The one or more compound may elicit a perception of saltiness. In embodiments, the one or more compound is included in a food product that contains a salt that elicits a salty taste. Preferably, at least one of the one or more compounds are taste modulating compounds or salty taste modulating compounds. In embodiments, at least one of the one or more compounds are salty taste modulating compounds and are present in the food product in an amount or concentration sufficient to elicit or enhance the perception saltiness. In embodiments, the one or more salty taste modulating compounds are present in the food product in an amount or concentration sufficient to elicit or enhance the perception of salty taste such that about 1% or less (e.g., about 2% or less, about 5% or less, about 7% or less, about 8% or less, about 9% or less, about 10% or less, about 11% or less, about 14% or less, about 15% or less, about 20% or less. about 22% or less, about 25% or less, about 30% or less, about 40% or less, about 50% of less, or about 60% or less) of the salt may be included in the food product to elicit a similar perception of saltiness as a substantially similar food product that does not include the one or more salty compounds. By way of example, one or more salty

taste modulating compound may be present in a food product in an amount sufficient to reduce the amount of a salt, such as sodium chloride, by about 1% or more, about 2% or more, about 5% or more, about 7% or more, about 8% or more, about 10% or more, about 11% or more, about 12% or more, about 15% or more, about 20% or more, about 22% or more, about 25% or more, about 30% or more, about 35% or more, about 40% or more, about 45% or more, about 50% or more, about 55% or more, about 60% or more, about 65% or more, about 70% or more, about 75% or more, about 80% or more, about 85% or more, about 90% or more, about 95% or more, or the like. The reduced salt food product elicits the same or similar perception of saltiness as a substantially similar food product that does not include the one or more salty taste modulating compounds.

[0102] In embodiments, the one or more bioactive, taste modulating, or salty taste modulating compounds are present in a food product in an amount or concentration sufficient to elicit or enhance the perception of salty taste such that the amount of sodium may be reduced by about 10 mg or more per serving relative to a substantially similar food product that does not have the one or more salty compounds while having a similar salty taste. In embodiments, the one or more bioactive, taste modulating, or salty taste modulating compounds are present in a food product in an amount or concentration sufficient to elicit or enhance the perception of salty taste such that the amount of sodium in a serving of a food product may be reduced to about 150 mg or less, more particularly to about 100 mg or less, more particularly to about 75 mg or less, more particularly to about 25 mg or less, more particularly to about 10 mg or less. By way of example, it may be desirable to reduce sodium by about 10 mg or more in cereals or snacks per serving relative to a substantially similar food product that does not have the one or more salty compounds while having a similar salty taste. It may be desirable to reduce sodium to about 150 mg or less, more particularly to about 100 mg or less, more particularly to about 75 mg or less, more particularly to about 25 mg or less, more particularly to about 10 mg or less in cereals or snacks per serving. For cereal, a typical serving size is 50 grams. Of course, cereals may have other serving sizes.

[0103] In embodiments, the one or more bioactive, taste modulating, or salty taste modulating compounds are present in a food product in an amount or concentration sufficient to elicit or enhance the perception of salty taste such that the amount of sodium may be reduced by about 20 mg or more per serving relative to a substantially similar food product that does not have the one or more salty compounds while having a similar salty taste. In embodiments, the one or more bioactive, taste modulating, or salty taste modulating compounds are present in a serving of a food product in an amount or concentration sufficient to elicit or enhance the perception of salty taste such that the amount of sodium may be reduced to about 800 mg or less, more particularly to about 500 mg or less, more particularly to about 300 mg or less, more particularly to about 100 mg or less, more particularly to about 20 mg or less. By way of example, it may be desirable to reduce sodium by about 20 mg or more in meals per serving. It may be desirable to reduce sodium to about 800 mg or less, more particularly to about 500 mg or less, more particularly to about 300 mg or less, more particularly to about 100 mg or less, more particularly to about 20 mg or less in meals per serving.

[0104] In embodiments, the one or more bioactive, taste modulating, or salty taste modulating compounds are present in a food product in an amount or concentration sufficient to elicit or enhance the perception of salty taste such that the amount of sodium may be reduced by about 100 mg or more per serving relative to a substantially similar food product that does not have the one or more salty compounds while having a similar salty taste. In embodiments, the one or more bioactive, taste modulating, or salty taste modulating compounds are present in a serving of a food product in an amount or concentration sufficient to elicit or enhance the perception of salty taste such that the amount of sodium may be reduced to about 800 mg or less, more particularly to about 500 mg or less, more particularly to about 300 mg or less, more particularly to about 200 mg or less, more particularly to about 100 mg or less relative to a substantially similar food product that does not have the one or more salty compounds while having a similar salty taste. By way of example, it may be desirable to reduce sodium by about 100 mg or more in soups per serving. It may be desirable to reduce sodium to about 800 mg or less, more particularly to about 500 mg or less, more particularly to about 300 mg or less, more particularly to about 200 mg or less, more particularly to about 100 mg or less in soups per serving. For soup, a typical serving size is 250 grams. Of course, soups may have other serving sizes.

[0105] Any suitable combination of bioactive, taste modulating, or salty taste modulating compounds may be included in a food product. In embodiments, a food product includes a combination of salty compounds such that the combination contains at least two structurally diverse salty compounds.

[0106] The one or more bioactive, taste modulating, or salty taste modulating compounds may be present in a food product in any suitable concentration. By way of example, a bioactive, taste modulating, or salty taste modulating compound may be present in a food product at a concentration of about 0.01% by weight or greater, about 2% by weight or less, or from about 0.01 % by weight to about 2% by weight. It will be understood that the concentration of the salt or salts in the food product may affect the desired concentration of the bioactive, taste modulating, or salty taste modulating compound. For example, if more salt is present, less bioactive, taste modulating, or salty taste modulating compound may be desired. In addition, it will be understood that the presence of more than one bioactive, taste modulating, or salty taste modulating compound may affect the desired concentration of other bioactive, taste modulating, or salty taste modulating compounds, particularly if the effects of the bioactive, taste modulating, or salty taste modulating compounds are additive or synergistic.

[0107] Any salt that imparts a salty taste may be present or incorporated into a food product that contains a bioactive, taste modulating, or salty taste modulating compound. The most commonly used salt for food applications is sodium chloride (typically referred to as common table salt). Other illustrative sources of sodium salts that may be present of incorporated into a food product include sodium phosphates, mono sodium glutamate, sodium nitrite, sodium nitrate, sodium bicarbonate, sodium lactate, sodium citrate, and sodium stearoyl lactylate. Similar lithium, potassium, ammonium or other alkali earth salts may be present or included in addition or as an alternative to one or more sodium salts.

[0108] In embodiments, a food product includes sodium chloride as a salt that imparts a salty taste. Sodium chloride may be present in the food product at any suitable amount or concentration. In embodiments, sodium chloride is present in the food product in an amount up to about 10.0 weight percent, more particularly, up to about 5.0 weight percent, even more particularly up to about 1.2 weight percent, or in the range of about 0.017 to about 1.2 weight percent, or about 0.1 to about 1, or about 0.4 to about 0.6 weight percent. In embodiments, a food product that includes one or more bioactive, taste modulating, or salty taste modulating compounds comprises no more than 0.04 weight percent, no more than 0.1 weight percent sodium, no more than 0.2 weight percent, no more than 0.25 weight percent sodium, no more than 0.3 weight percent, no more than 0.4 weight percent, no more than 0.5 weight percent sodium, no more than 0.75 weight percent sodium, no more than 1 weight percent sodium, no more than 5 weight percent sodium, or no more than 10 weight percent sodium. It will be understood that a desired weight percent of sodium may vary depending on the type of food product. For example, it may be desirable for a seasoning to have a higher weight percent sodium than a soup or a breakfast cereal. In embodiments, a food product that includes one or more bioactive, taste modulating, or salty taste modulating compounds comprises no more than 100 mg sodium per serving, no more than 250 mg sodium per serving, no more than 500 mg sodium per serving.

[0109] One or more bioactive, taste modulating, or salty taste modulating compounds may be utilized in connection with virtually any food product for which it is desired to elicit or enhance the perception of a salty taste. The bioactive, taste modulating, or salty taste modulating compounds can find application for imparting saltiness to beverages or food dishes or as an ingredient in snack foods or other food products in which saltiness is desired.

[0110] Examples of food products that may incorporate one or more bioactive, taste modulating or salty taste modulating compound include a confectionary, a gum, a bakery product, an ice cream, a dairy product, a fruit snack, a chip or crisp, an extruded snack, a tortilla chip or corn chip, a popcorn, a pretzel, a nut, a snack bar, a meal replacement, a ready meal, a soup, a pasta, a canned food, a frozen processed food, a dried processed food, an instant noodle, a chilled processed food, an oil or fat, a sauce dressing or condiment, a dip, a pickled product, a seasoning, a baby food, a spread, a chip or a crisp such as chips or crisps comprising potato, corn, rice, vegetable (including raw, pickled, cooked and dried vegetables), a fruit, a grain, a soup, a seasoning, a baked product such as a ready-to-eat breakfast cereal, hot cereal or dough, an ice cream such as a frozen yogurt, a dairy products such as a yogurt or cheese, ready meal, a soup, a pasta, a canned food, a frozen processed food, a dried processed food, an instant noodle, or a chilled processed food, a beverage including beverages that include fiber or protein a meat or a meat substitute, a pet food, an animal product, and a medical food.

[0111] In embodiments, one or more bioactive, taste modulating or salty taste modulating compounds are incorporated into a nutritional supplement, a vitamin supplement, an infant formula product, a medicinal or pharmaceutical product, or the like.

[0112] In embodiments, a food product is a processed food product. Food processing includes the transformation of raw ingredients into food or transforming forms of food into other forms of food. Food processing often includes using harvested crops or animal products to produce marketable and often long shelf-life products. Processed food products include products for which additional processing by a consumer may be desired prior to consumption. For example, a food product for which heating, cooking, baking, or the like, may be desired by a consumer prior to consumption may be a processed food product despite not being in its final form (e.g., being unheated, uncooked, unbaked, etc.) prior to delivery to a consumer.

[0113] Particularly suitable food products including soup, meal kits, grain products such as ready-to-eat cereals, snacks, bars and baked dough, and dairy products such as ice cream, yogurt and cheese. In some aspects, a bioactive, taste modulating, or salty taste modulating compound is used to reduce the amount of sodium salt that is typically included in soups, including (but not limited to) chicken or poultry broth, chicken- or poultry-based soups (such as chicken noodle soup), tomato-based soups, and the like. In some aspects, a bioactive, taste modulating, or salty taste modulating compound is used to reduce sodium salt in meal kits, such as kits that include ingredients to be combined with meat to prepare a meal. Such meal kits can include dried components (such as noodles, rice, dried potatoes, or the like) and seasoning packages. In some aspects, a bioactive, taste modulating, or salty taste modulating compound is used to reduce the sodium chloride that is typically added to a snack food to enhance its flavor. Exemplary snack foods include potato chips, corn chips, pretzels, fruit-type snacks, and snack mixes including any mixes of any of these foods with other ingredients (such as cereals).

[0114] In some aspects, a bioactive, taste modulating, or salty taste modulating compound is used to reduce the amount of sodium salt that is typically included in a ready-to-eat cereal or other grain-based food products, such as dough, baked goods, grain snacks, grain bars, or the like. In some aspects, a bioactive, taste modulating, or salty taste modulating compound is used to reduce the amount of sodium salt that is typically included in dairy-based food products, such as fresh or frozen dairy products, which may include yogurt, ice cream, or the like. In some aspects, a bioactive, taste modulating, or salty taste modulating compound is used to reduce the amount of sodium salt that is typically included in packaged meal food products, such as packaged meals that contain rice, potatoes, or vegetables, dry packaged meals, frozen packaged meals, or the like.

[0115] For the purposes of the present disclosure "grain" includes grain and pseudograin. Examples of food grains include corn; sorghum; fonio; millet such as pearl millet, proso millet, finger millet, foxtail millet, Japanese millet, kodo millet and the like; Job's tears; wheat; rice; rye; barley; oat; triticale; wild rice; teff; amaranth; quinoa; buckwheat; and the like.

[0116] A bioactive, taste modulating, or salty taste modulating compound can also be used in connection with soup, broth, sauce (such as basting sauce), various seasoning sauces, ketchup, dressings, and other like foods.

[0117] A bioactive, taste modulating, or salty taste modulating compound can be employed to elicit the perception of salty taste or enhance the perceived salt taste of any salts used in food or beverage products. The preferred salt taste to be elicited or enhanced by the salty compounds is that of sodium chloride.

[0118] Moreover, a bioactive, taste modulating, or salty taste modulating compound described herein can be used to elicit or enhance the perceived salt taste of known salty tasting compounds that may be used as salt substitutes. Such compounds include amino acids such as cationic amino acids and low molecular weight peptides such as dipeptides and tripeptides. Specific examples of these compounds include arginine hydrochloride, lysine hydrochloride, and lysine-ornithine hydrochloride. These compounds exhibit a salty taste but are typically useful only at low concentrations since they exhibit a bitter flavor at higher concentrations. Ordinarily, these salt-tasting compounds will be used in concentrations in the range of about 1 to about 40 mM, or about 10 to about 30 mM. Thus, it is feasible to reduce the sodium chloride content of a food or beverage product by first formulating a food or beverage with less sodium chloride than is necessary to achieve a desired salt taste and then adding to said food or beverage a salty compound described herein in an amount sufficient to enhance the salt taste of the salted food or beverage to reach the desired taste. In addition, sodium chloride content may be further reduced by substituting a salt-tasting cationic amino acid, a low molecular eight dipeptide, or mixtures thereof, for at least a portion of the salt.

PROCESSING

[0119] A bioactive, taste modulating, or salty taste modulating compound, or derivative thereof, described herein can be added to food products in dry or liquid form. For example, a bioactive, taste modulating, or salty taste modulating compound that is in the liquid form can be prepared by simply dissolving or suspending the compound in an appropriate relative amount in an aqueous liquid. Useful aqueous liquids include water, alcohol-water mixtures, triacetin, propylene glycol, and triglycerides and other known organic solvents. Depending upon the concentration of the bioactive, taste modulating, or salty taste modulating compound, it can be desirable to heat the mixture to dissolve the compound.

[0120] Bioactive, taste modulating, or salty taste modulating compounds that exist in a dry state, such as powders or granules, can be prepared by either mixing or blending the compounds with other components in the dry state. The dry blending or mixing can be carried out in any conventional suitable apparatus. In some aspects, the salty taste modulating compounds described herein can be prepared into dry compositions by commonly used methods of granulation from mixtures of the several ingredients, preferably initially conveniently smaller than forty mesh. Such starting mixtures can be wetted in known manner, granulated, and their granulations dried as usual and screened to give a product approximately the typical size of common table salt, for example, by taking the fraction passing through the thirty mesh screen and retained on the forty mesh screen.

[0121] Bioactive, taste modulating, or salty taste modulating compounds that exist in a dry composition state can be alternatively prepared by first forming a solution, suspension or emulsion of the compounds and other individual components, and then extruding or drying the solution, suspension or emulsion. The preparation of the solution or suspension of the components can be carried out as described above in the context of preparing the liquid flavoring agents. The thus-prepared solution or suspension can then be dried using any conventional suitable apparatus, such as a rotary drier, a drum drier, or a fluidized bed drier or spray drier.

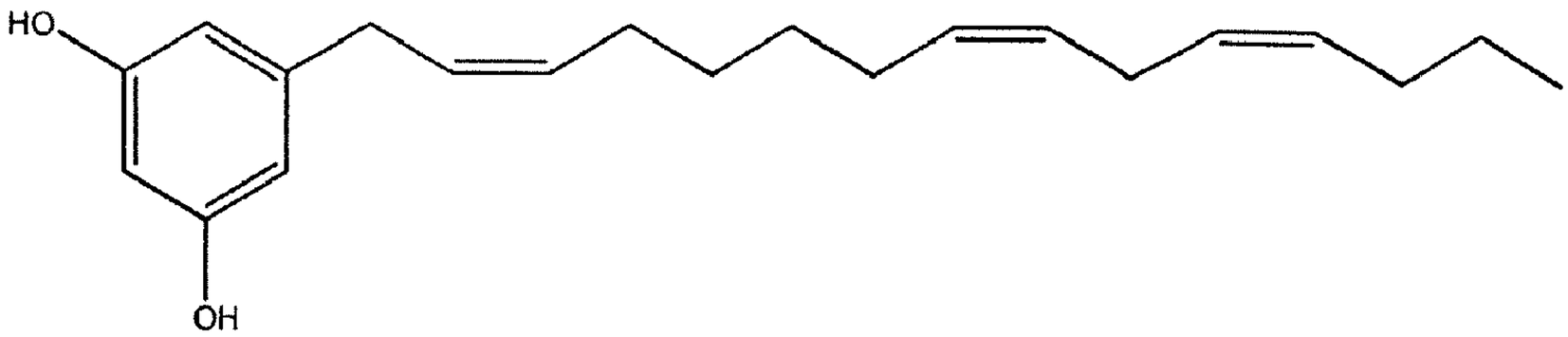
[0122] Bioactive, taste modulating, or salty taste modulating compounds described herein can be prepared by thoroughly mixing the compounds with other components in the indicated proportions until a suitably mixed (for example, homogeneous) product is attained.

[0123] Compositions or formulations containing the bioactive, taste modulating, or salty taste modulating compounds can then be combined with a food product.

Patentkrav

1. Anvendelse af

mindst én forbindelse (a) der er syntetiseret eller afledt af et naturprodukt og er valgt fra gruppen bestående af følgende forbindelser:



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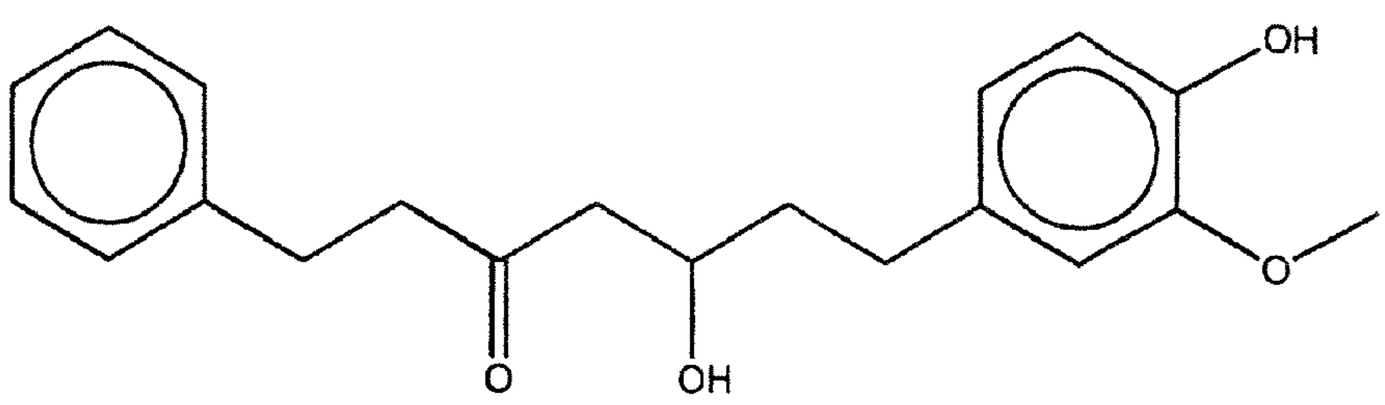

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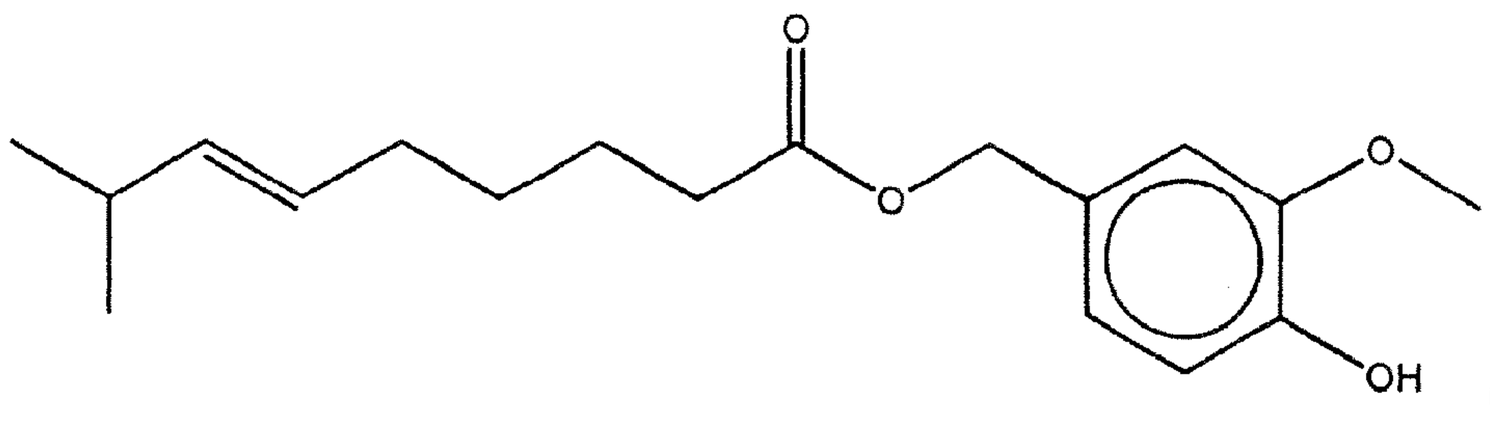

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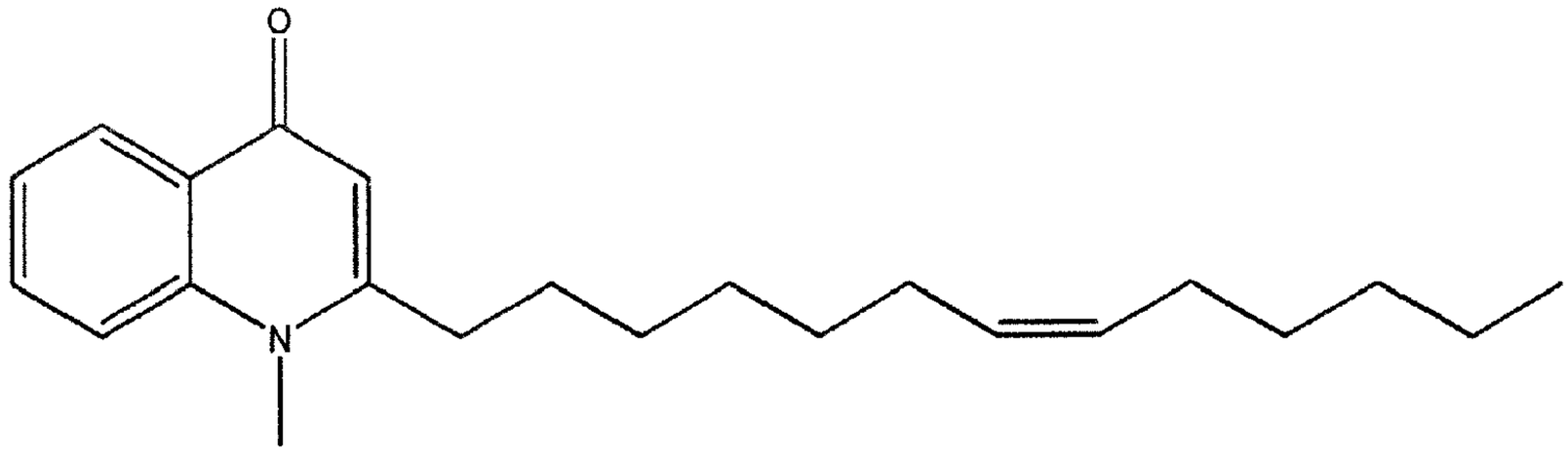

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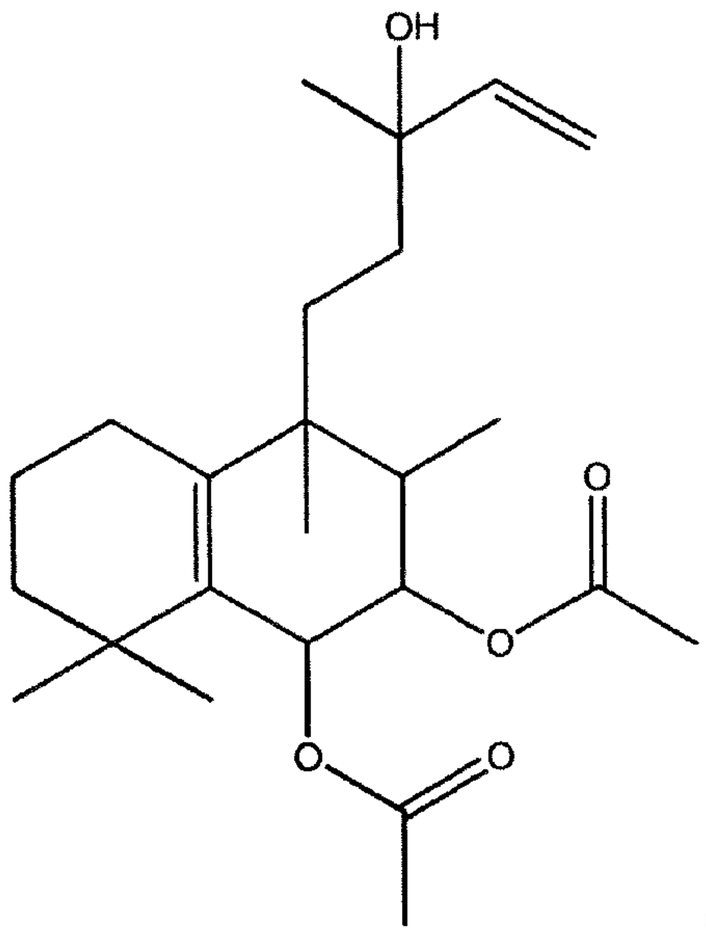

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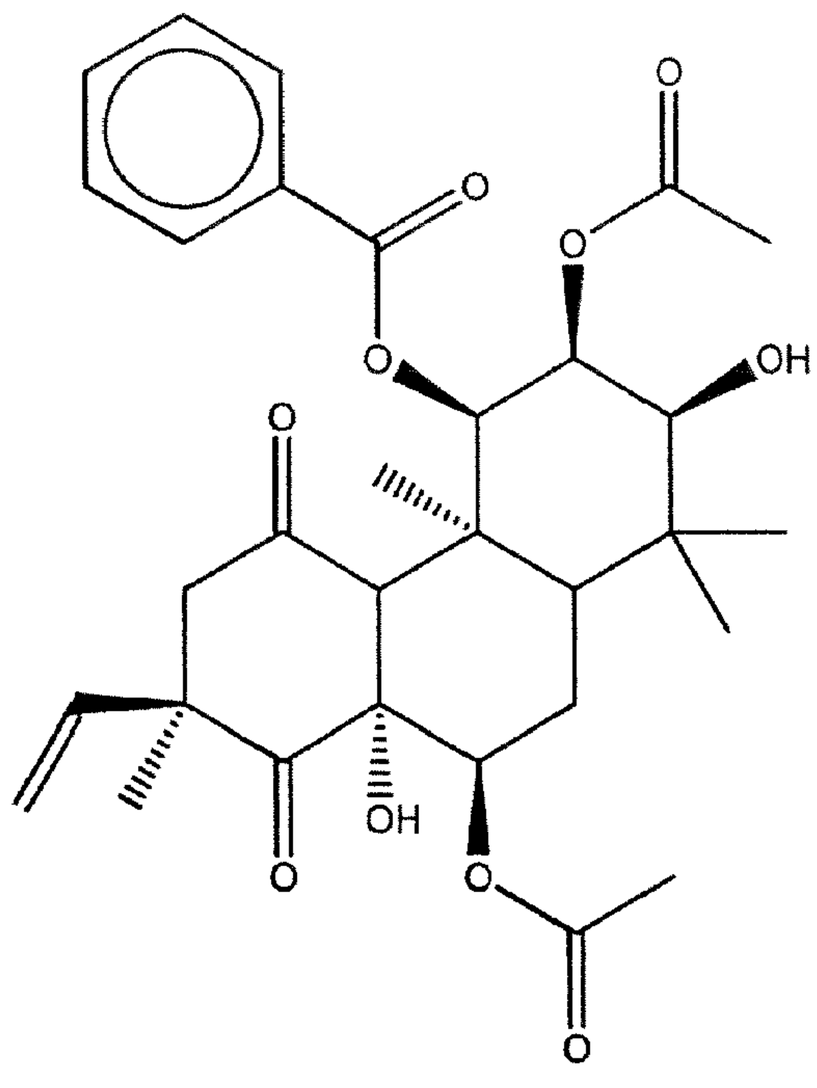

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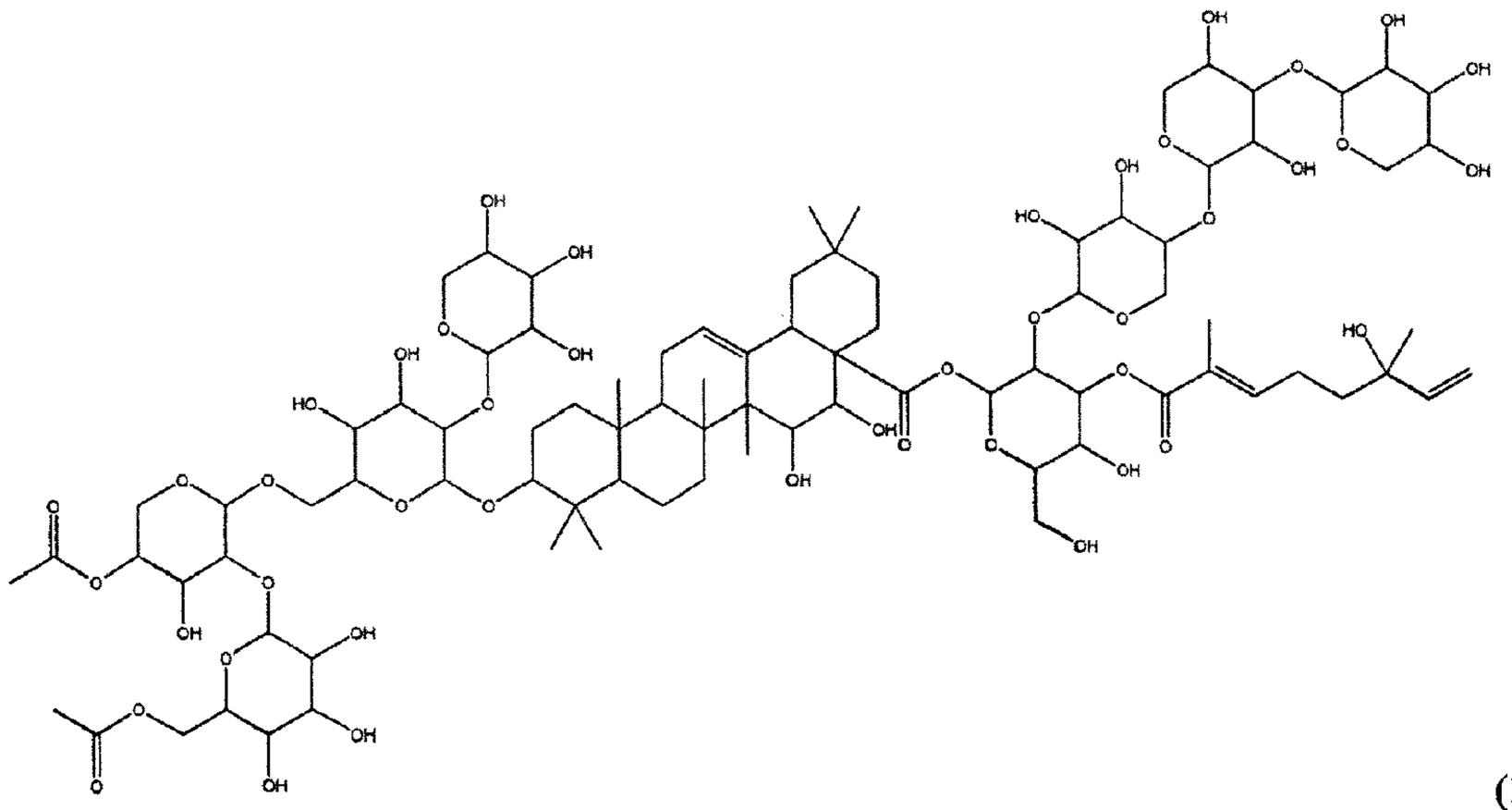

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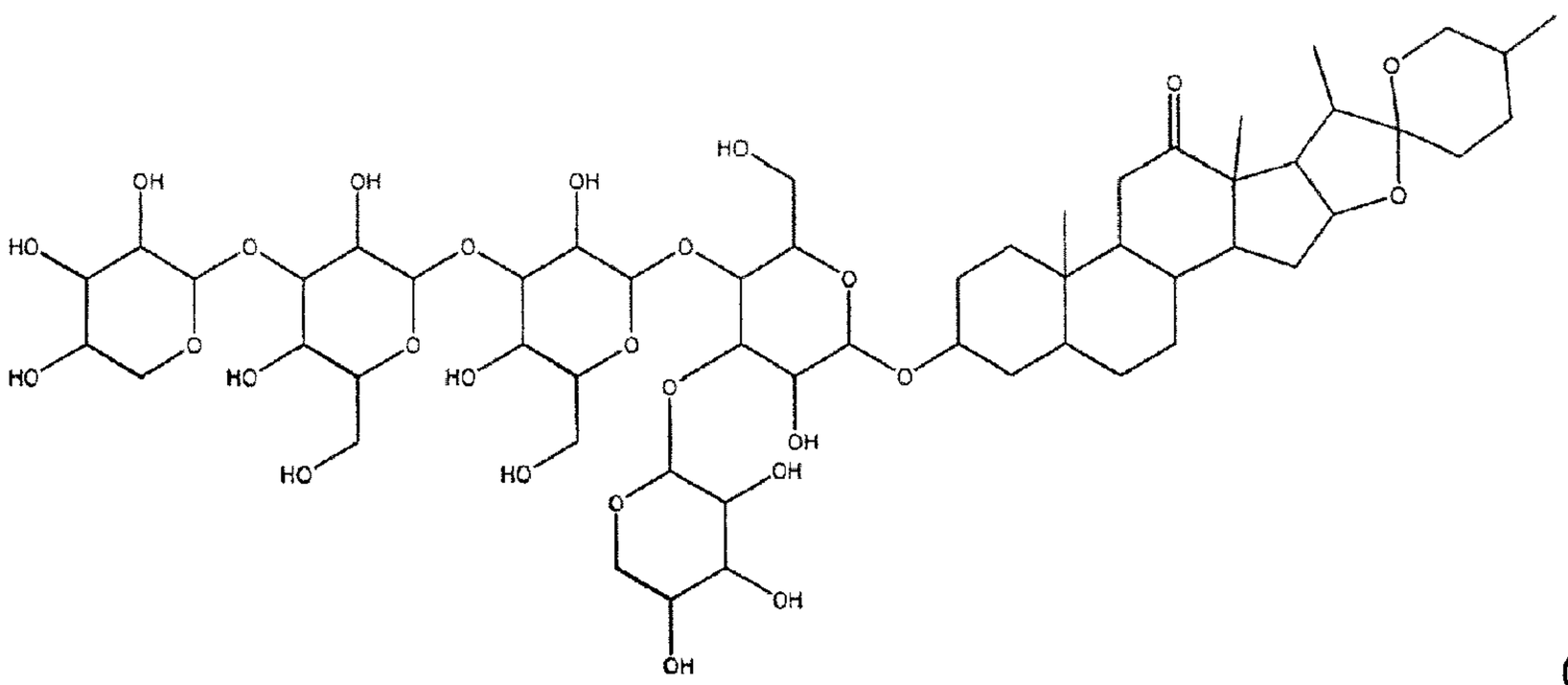

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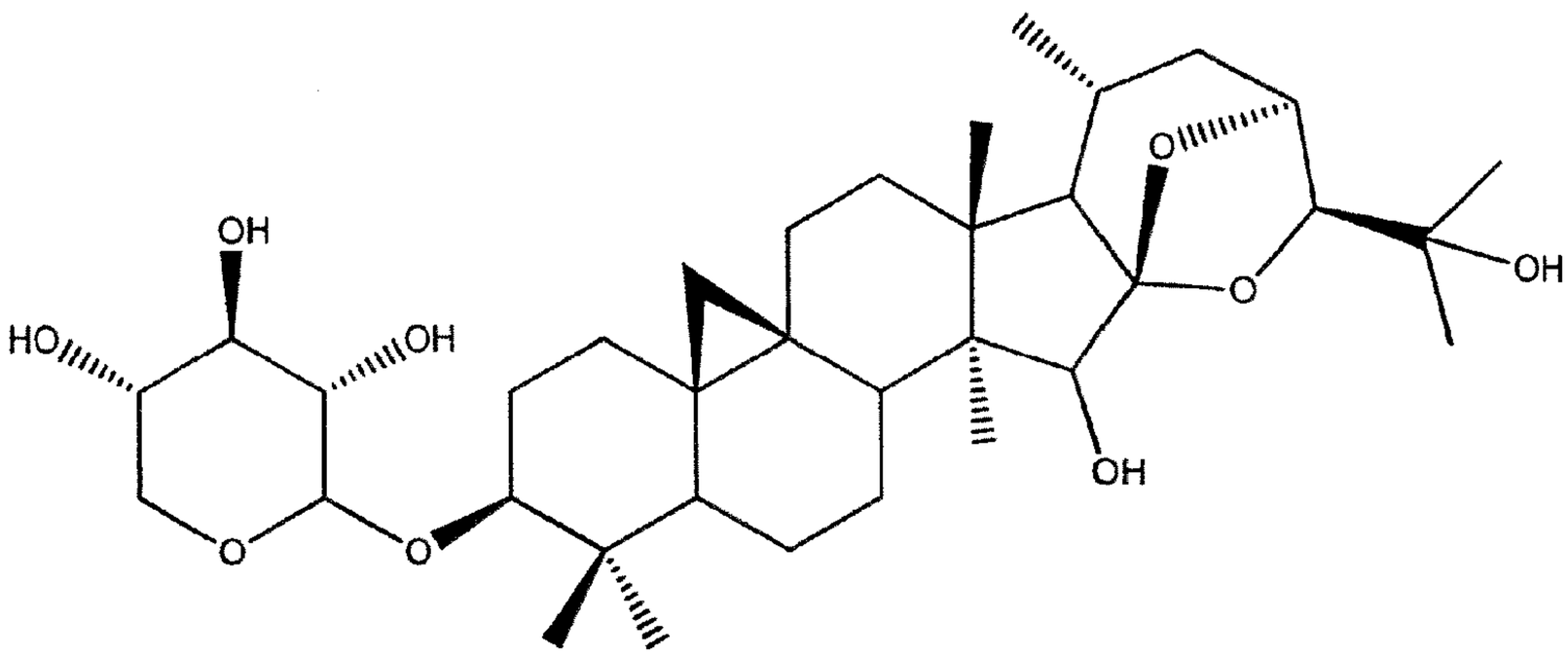

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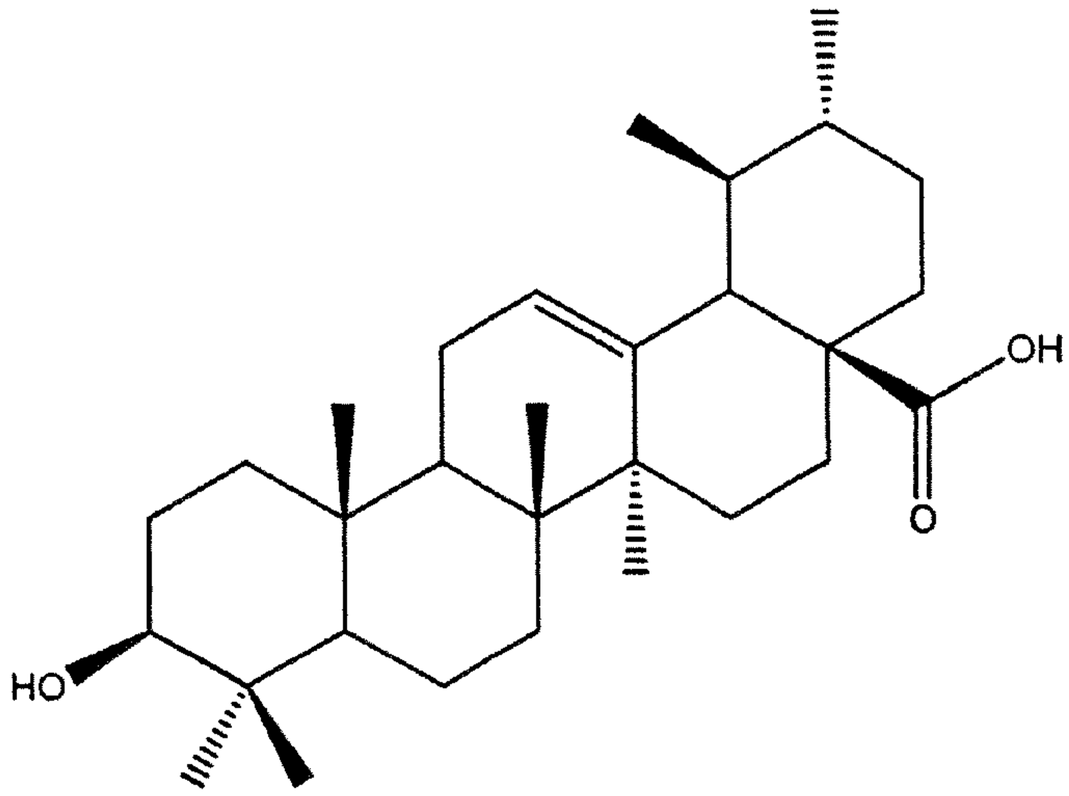

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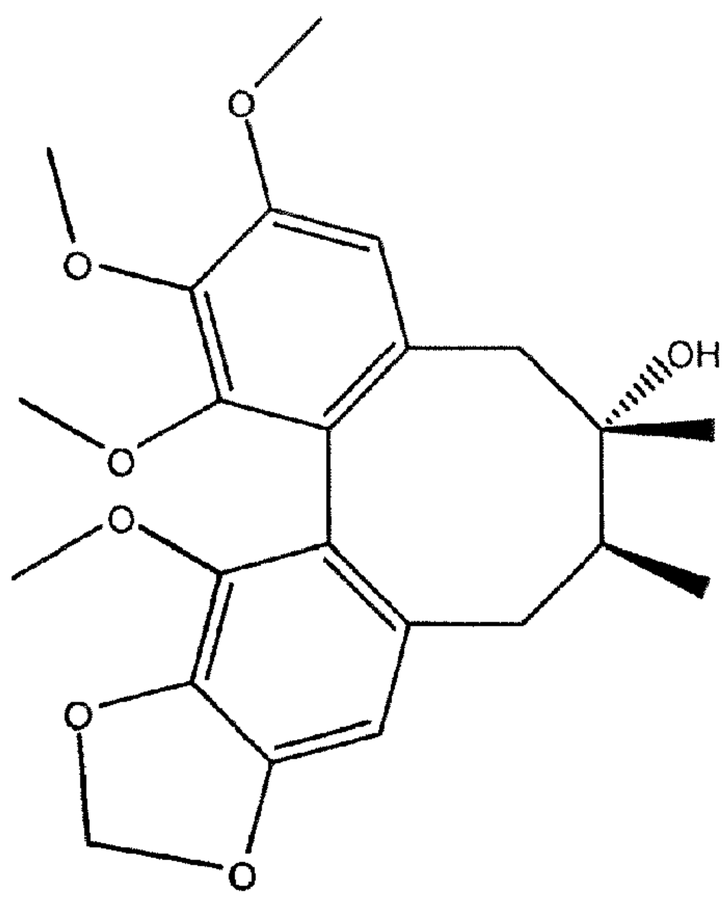

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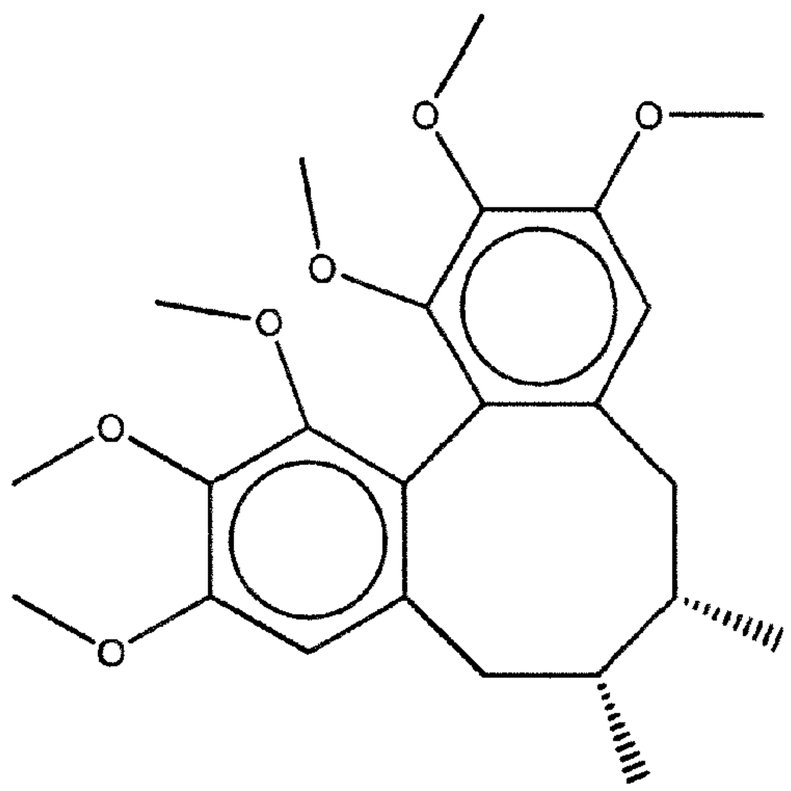

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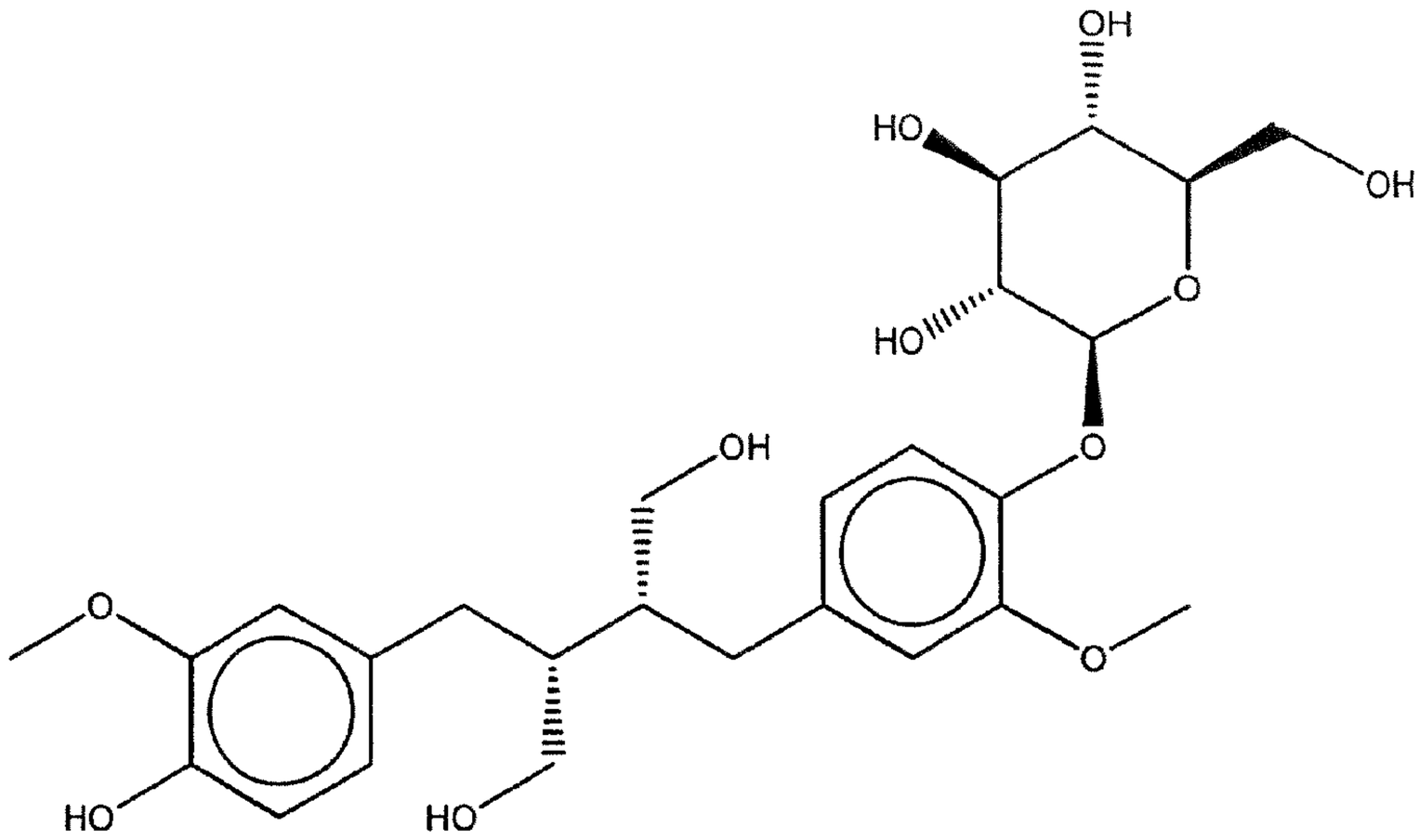

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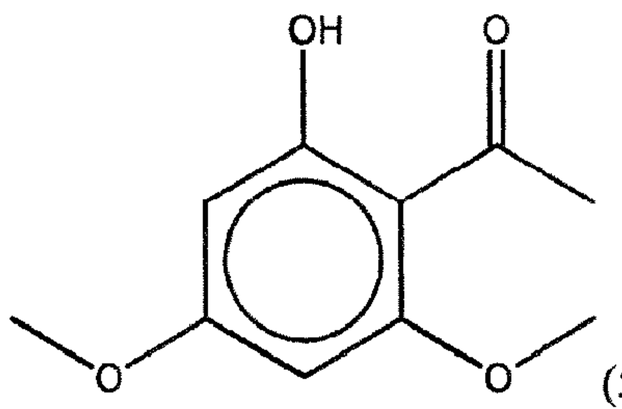

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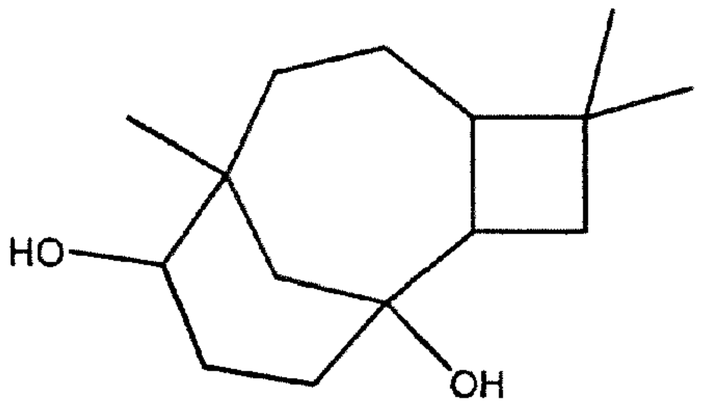

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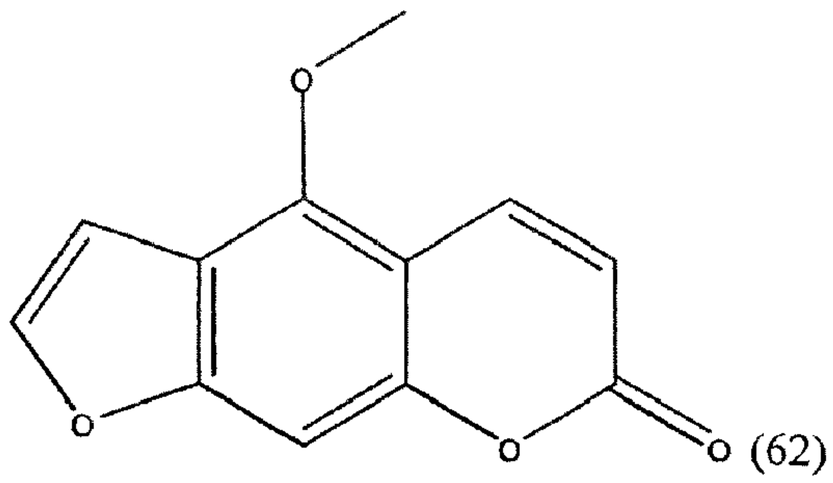

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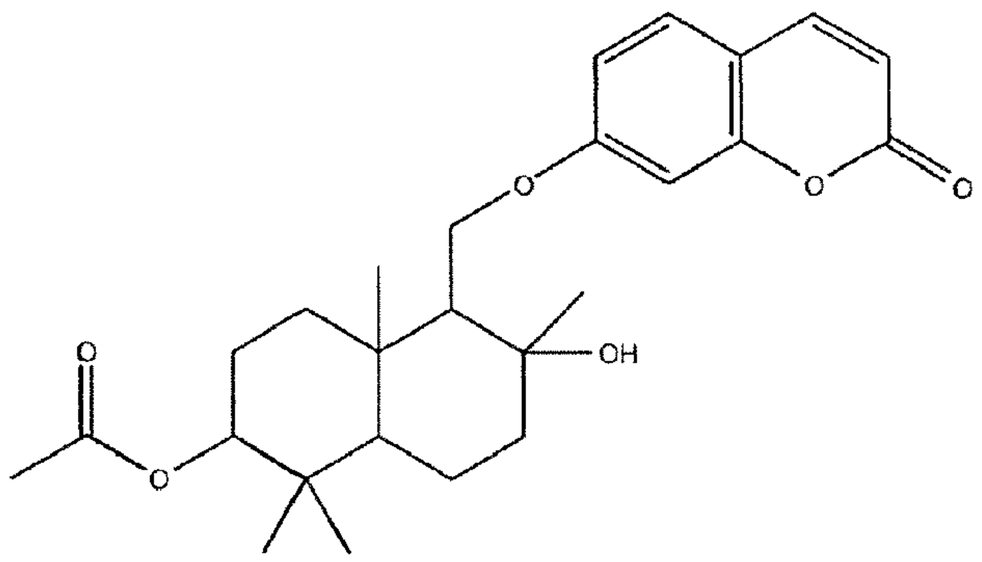

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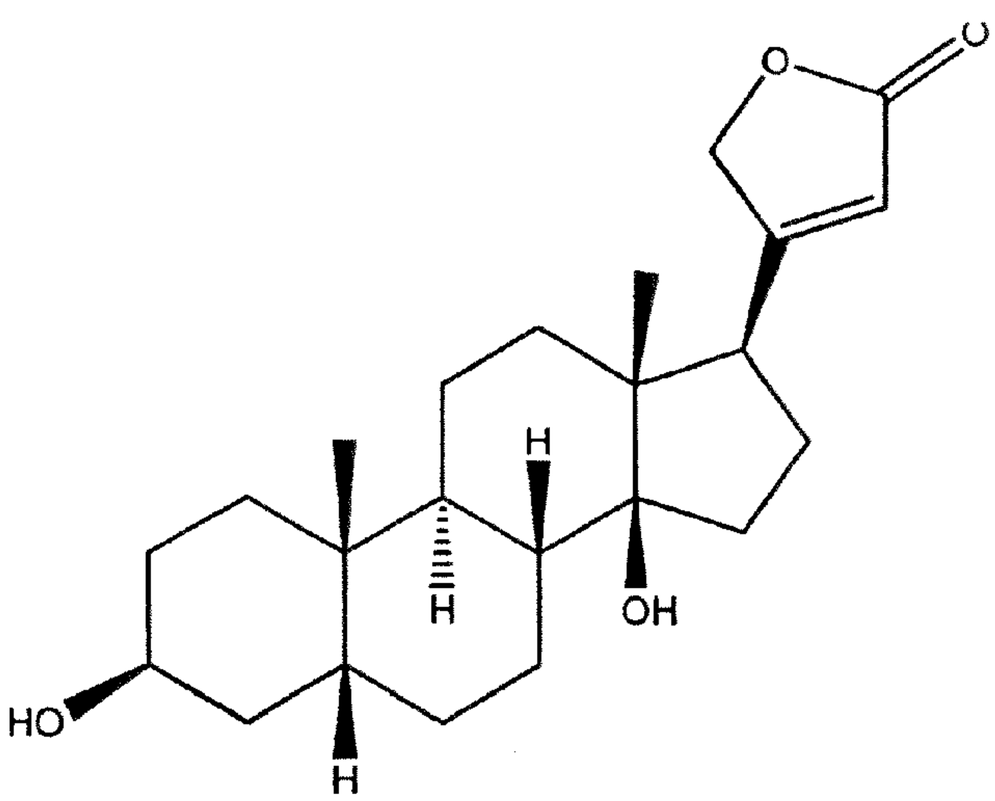

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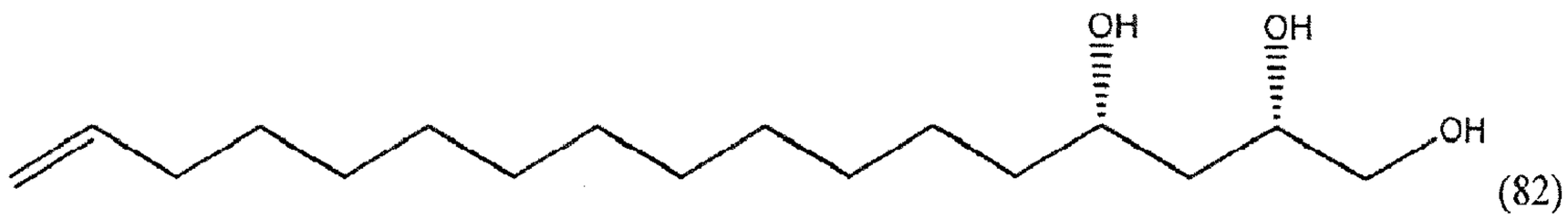

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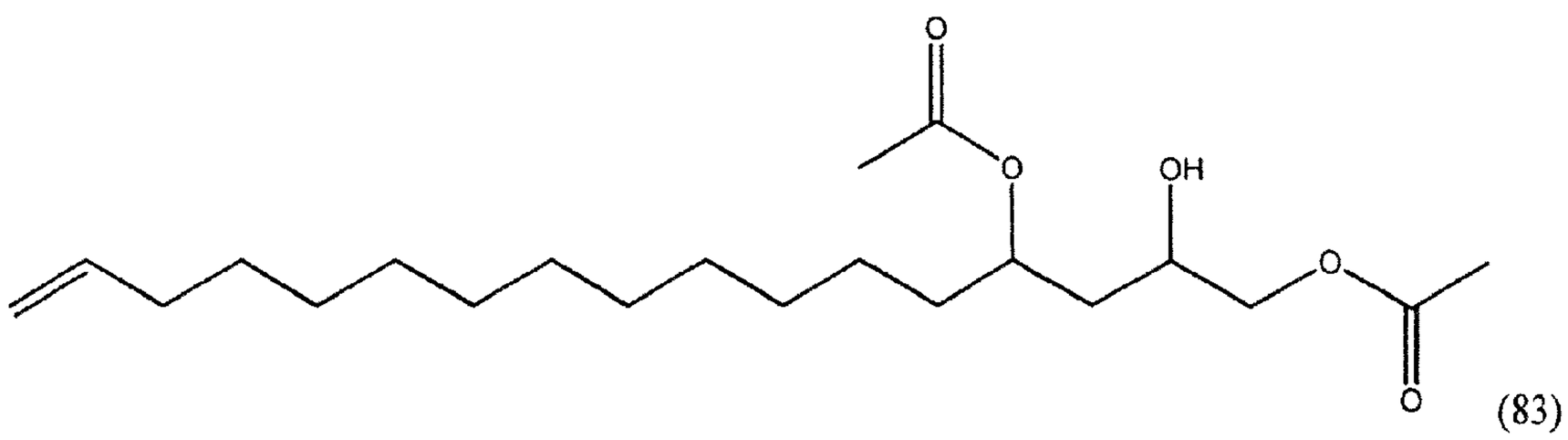

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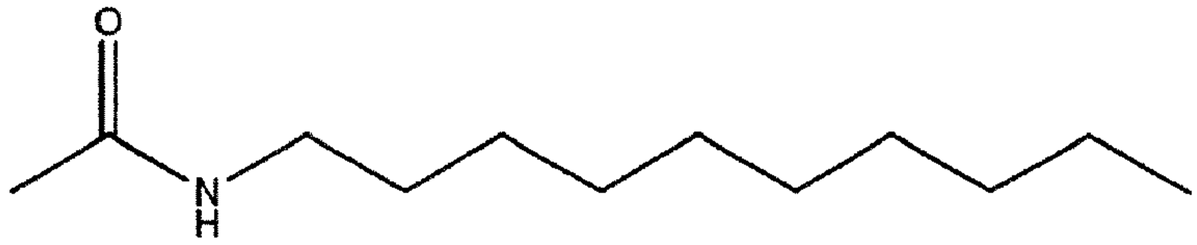


(84),

hvor forbindelse (a) er separeret fra dens naturligt forekommende omgivelser hvis den er afledt fra et naturprodukt,

til erstatning af natriumchlorid i et fødevareprodukt.

2. Anvendelsen ifølge krav 1, hvor mindst to forbindelser valgt fra gruppen bestående af forbindelserne (10), (12), (13), (16), (29), (33), (36), (37), (41), (43), (44), (45), (48), (53), (56), (62), (66), (73), (82), (83), og (84) vist i krav 1, anvendes.

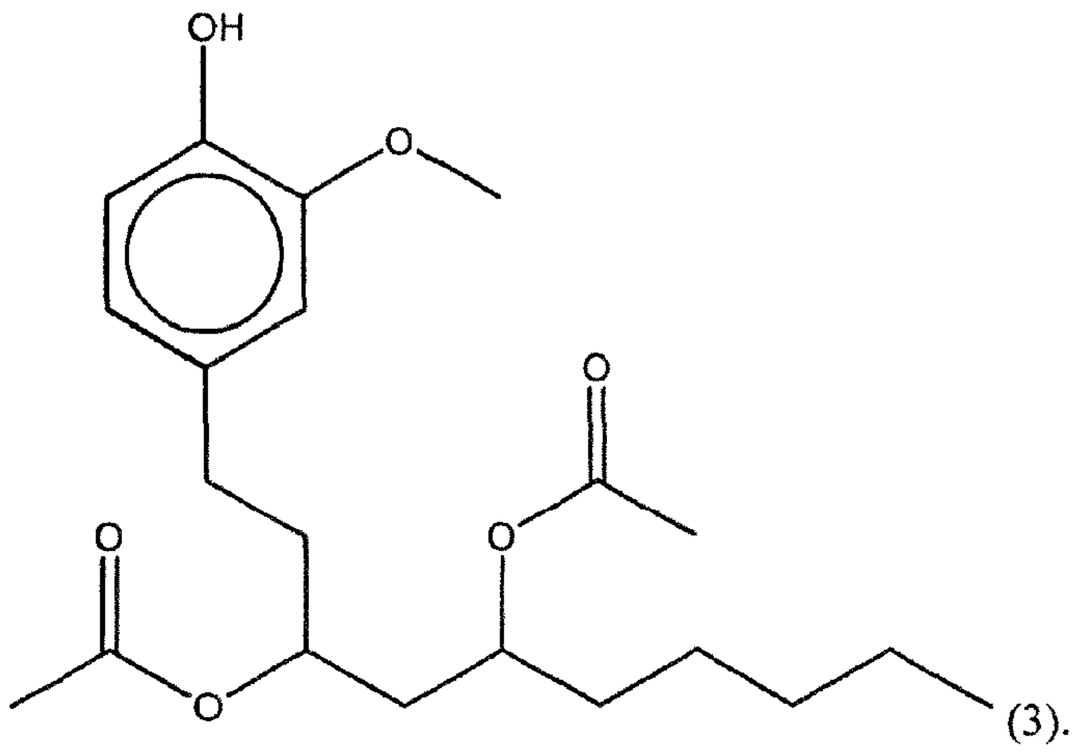
3. Anvendelsen ifølge krav 1, hvor mindst tre forbindelser valgt fra gruppen bestående af forbindelser (10), (12), (13), (16), (29), (33), (36), (37), (41), (43), (44), (45), (48), (53), (56), (62), (66), (73), (82), (83), og (84) vist i krav 1, anvendes.

4. Anvendelsen ifølge krav 1, hvor mindst to forbindelser valgt fra gruppen bestående af forbindelserne (10), (12), (13), (36), (45), (56), (82), og (83) vist i krav 1, anvendes.

5. Anvendelsen ifølge krav 1, hvor mindst tre forbindelser valgt fra gruppen bestående af forbindelser (10), (12), (13), (36), (45), (56), (82), og (83) vist i krav 1, anvendes.

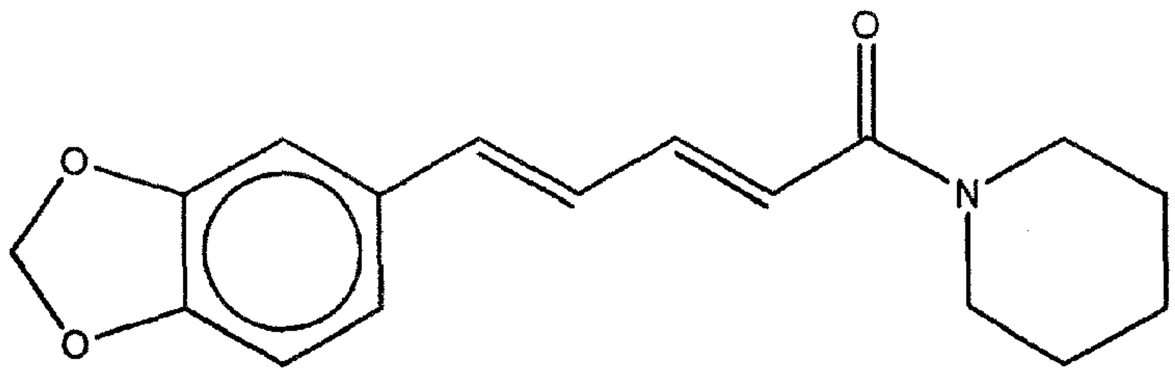
6. Anvendelsen ifølge krav 1, hvor forbindelserne (12), (13) og (82) vist i krav 1, anvendes.

7. Anvendelsen ifølge et hvilket som helst af de foregående krav, yderligere anvendende forbindelse (3)



(3).

8. Anvendelsen ifølge et hvilket som helst af de foregående krav, yderligere anvendelse af forbindelse (18)



(18).

9. Anvendelsen ifølge et hvilket som helst af kravene 1 til 8, hvor fødevareproduktet ikke omfatter mere end 500 mg natrium pr. servering, eller ikke mere end 300 mg natrium pr. servering, eller ikke mere end 100 mg natrium pr. servering.

10. Anvendelsen ifølge krav 1, hvor fødevareproduktet også indeholder et salt (c) der tildeler en saltagtig smag, hvor salt (c) er valgt fra natrium-, lithium-, kalium-, ammonium- eller jordalkalisalt med anionen af saltet valgt fra chlorid, phosphat, glutamat, nitrit, nitrat, bicarbonat, lactat, citrat og stearoyllactylat.

11. Anvendelsen ifølge krav 10, hvor salt (c) er natriumchlorid.

12. Anvendelsen ifølge et hvilket som helst af kravene 1 til 11, hvor forbindelse (a) anvendt var fremstillet syntetisk.

13. Anvendelsen ifølge et hvilket som helst af kravene 1 til 11, hvor forbindelse (a) anvendt var ekstraheret fra naturlige kilder valgt fra planter og mikrobielle kilder.

14. Anvendelsen ifølge krav 12 eller 13, hvor forbindelse (a) anvendt var isoleret eller oprenset.

15. Anvendelsen ifølge et hvilket som helst af kravene 1 til 14, hvor forbindelse (a) er til stede i fødevareproduktet i en mængde på 0,01 til 2 vægt%.

16. Anvendelsen ifølge et hvilket som helst af de foregående krav, hvor forbindelse (a) er valgt fra forbindelserne (10), (12), (29), (36), (37), (48), (56), (66), (83), og (84) vist i krav 1.

Compound		12	13	83	10	37	36	45	18	56	82	3	84	41	48	53	44	62	43
	Conc.																		
12	1 ppm	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
13	10 ppm	3.4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
83	1 ppm	3.2; 4.2	3.7; 4.5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10	1 ppm	3.9	3.1	3.9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
37	10 ppm	3.0; 4.4	3.5	4.1	4.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X
36	0.1 ppm	3.9	3.8	3.5	3.3; 3.4	3.1	X	X	X	X	X	X	X	X	X	X	X	X	X
45	10 ppm	3.6; 3.9	3.4; 4.1	2.4; 3.4	3.4	3.3	4	X	X	X	X	X	X	X	X	X	X	X	X
18	10 ppm	2.6; 4.0	3.1	3.2; 3.9	3.3	3.8	3.4	2.7; 3.3	X	X	X	X	X	X	X	X	X	X	X
56	10 ppm	2.6	3.4	3.8	4.1	3.4; 4.4	3.1; 3.7	3.1	3.4	X	X	X	X	X	X	X	X	X	X
82	1 ppm				3.2					3.4	X	X	X	X	X	X	X	X	X
3	0.1 ppm						3.5					X	X	X	X	X	X	X	X
84	1 ppm		3.8		3.2				3.5		3.4		X	X	X	X	X	X	X
41	10 ppm				3.3					3	3.1			X	X	X	X	X	X
48	10 ppm					3.4	3.3					3.3			X	X	X	X	X
53	1 ppm		3.0						2.9				3.0			X	X	X	X
44	10 ppm	3.2				3.3		3.1							3	2.8	X	X	X
62	10 ppm			3.0	3.1					3.0	2.9			2.9				X	X
43	10 ppm	3.1					3.2					3.1	3.1		3.1				X

FIG. 1

Compound (Concentration)	12	13	83	10	37	36	45	18	56	82	3	84	41	48	53	44	62	43
12 (1 ppm)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
13 (10 ppm)	7.9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
83 (1 ppm)	8.0	7.9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10 (1 ppm)	7.7	7.9	7.9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
37 (10 ppm)	8.1				X	X	X	X	X	X	X	X	X	X	X	X	X	X
36 (0.1 ppm)	8.1	7.8	7.8			X	X	X	X	X	X	X	X	X	X	X	X	X
45 (10 ppm)	8.2		8.1				X	X	X	X	X	X	X	X	X	X	X	X
18 (10 ppm)	8.3-9.0	8.0	8.1	8.0		7.9		X	X	X	X	X	X	X	X	X	X	X
56 (10 ppm)	8.1	7.9	8.0	8.0		8.2			X	X	X	X	X	X	X	X	X	X
82 (1 ppm)	8.3			7.6		7.6	8.2	8.3	7.9	X	X	X	X	X	X	X	X	X
3 (0.1 ppm)	8.2	7.7	7.9	7.9		8.5	8.4	8.3	7.9	8.3	X	X	X	X	X	X	X	X
84 (1 ppm)	8.2	8.8		8.0		7.7	8.1	7.8	7.9			X	X	X	X	X	X	X
41 (10 ppm)	7.7	7.8									7.6	X	X	X	X	X	X	X
48 (10 ppm)	7.8												X	X	X	X	X	X
53 (1 ppm)	8.0	8.1	7.9	7.6		8.1				8.0	7.9	8.0		X	X	X	X	X
44 (10 ppm)	7.4	7.7	7.8	8.1		7.9				7.9	8.0	7.8			X	X	X	X
62 (10 ppm)	7.7											7.5				X	X	X
43 (10 ppm)	7.8	8.0	7.8	7.9		8.0				8.0	7.9	7.8			8.1		X	X

FIG. 2

DK/EP 3366677 T3