(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 April 2007 (19.04.2007)

PCT

(10) International Publication Number
WO 2007/042287 A2

(51) International Patent Classification:
A23L 1/226 (2006.01) *A23L 1/39* (2006.01)
A23L 1/227 (2006.01)

(21) International Application Number:
PCT/EP2006/009838

(22) International Filing Date: 11 October 2006 (11.10.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0520872.3 14 October 2005 (14.10.2005) GB

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 2007/042287 A2

(54) Title: ONION FLAVOUR COMPOUNDS AND USE

(57) Abstract: The invention relates to compounds of O-alkylated sulphur-containing amino acids or peptides that provide an onion flavour to consumables and flavour compositions, and to consumables and flavour compositions comprising such compounds.

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ONION FLAVOUR COMPOUNDS AND USE

This invention relates to onion flavour compounds, to the use of onion flavour compounds in consumables, and to flavour compositions and consumables comprising such compounds.

Flavours, apart from displaying the desired flavour notes, should not provide other undesired flavour notes. The latter include in particular bitter or metallic notes which are generally found undesirable by consumers. For certain applications, additional flavour notes (for example salty, kokumi, sweet or sour) can be of interest, but will limit the application range of a given flavour compound.

In addition to the presence of the desired flavour note and the absence of undesired ones, flavour compounds should preferably have one or more of the following characteristics: they should be inexpensive to produce, and stable during long periods of storage and to processing conditions that may comprise elevated temperatures and humidity, and extremes of pH. Further, the compounds should display the desired onion note over a wide range of pH, in particular pH 3 to pH 8.

The applicant identified O-alkylated sulphur-containing amino acids or peptides according to formula I hereinunder which are able to provide an onion flavour to consumables and fulfil the abovementioned requirements.

The flavour of freshly-cut onions is to a large extent based on a great variety of sulphur compounds. The main contributing sulphur compounds are propanthial-S-oxide and four different classes of thiosulfinates: completely saturated thiosulfinates (e.g. CH_3-S(O)-S-CH_3), mono- or bis-β,γ-unsaturated thiosulfinates (e.g. CH_2-CH-CH_2-S(O)-S-CH_2-CH-CH_2 ,allicine), mono-α,β-unsaturated thiosulfinates (e.g. CH_3-S(O)-S-CH-CH-CH_3), and mixed α,β- and β,γ- unsaturated thiosulfinates (e.g. CH_2-CH-CH_2-S(O)-S-CH-CH-CH_3) (Block, Angew. Chem. 1992, 104, 1158-1203). 3-Mercapto-2-methylpentan-1-ol is a further intense flavour isolated from raw onions (Widder et al. J. Agric. Food Chem. 2000, 48, 418-423).

These known onion flavour compounds are difficult to isolate or synthesize chemically, and in consequence are usually expensive to produce.

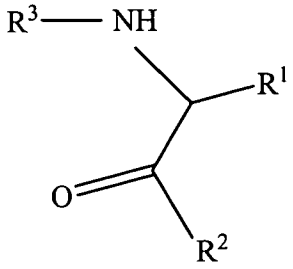
There remains a need for alternative or improved compounds that are easier to form, and that provide an onion flavour to flavour compositions and consumables.

Surprisingly, applicant has found that compounds of formula I are able to provide an onion flavour.

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In a first aspect, the invention is therefore directed to the use as a flavour of a compound of formula I,



I

wherein the residues R^1, R^2 and R^3 are selected as follows:

R^1 is a residue selected from the group consisting of $-CH_2SX$, $-CH_2CH_2SX$, and $-CH_2CH_2CH_2SX$, with X being a residue selected from H and $-CH_3$;

R^2 is a residue selected from $-C_1$-C_5 linear or branched alkoxy residue including $-O-CH_3$, $-O-CH_2-CH_3$, $-O-CH_2CH_2CH_3$, $-O-CH_2CH_2\ CH_2CH_3$, $-O-CH_2CH_2\ CH_2\ CH_2\ CH_3$, $-O-CH(CH_3)CH_3$, $-O-CH_2CH(CH_3)_2$, $-O-CH_2CH(CH_3)(CH_2CH_3)$, and $-O-CH_2CH_2CH(CH_3)_2$; and

R^3 is a residue selected from the group of H, and an aminoacid residue linked via a peptide bond selected from the group consisting of γ-Glu ($-CO-CH_2-CH_2-CH(NH_2)-COOH$), ß-Asp ($-CO-CH_2-CH(NH_2)-COOH$), α-Glu ($-CO-CH(NH_2)-CH_2-CH_2-COOH$), α-Asp ($-CO-CH(NH_2)-CH_2-COOH$), β-Ala ($-CO-\ CH_2-\ CH_2-NH_2$), α-Ala, α-Val, α-Leu, α-Ile, α-Met, α-Pro, α-Phe, α-Trp, α-Ser, α-Thr, α-Asn, α-Gln, α-Tyr, α-Cys, α-Lys, α-Arg, α-His, α-Asp, a gamma amino butyric acid (GABA), and an uncommon amino acid including 4-hydroxyprolin, ε-N,N,N-trimethyllysine, 3-methylhistindine, 5-hydroxylysine, O-phosphoserine, gamma-carboxyglutamate, ε-N-acetyllysine, ω-N-methylarginine, N-acetylserine, N,N,N-trimethylalanine, N-formylmethionine.

Standard abbreviations for amino acids are used throughout this text to identify their residues within a larger compound rather than the free amino acid, for example R^3 above may be a residue of γ-Glu ($-CO-CH_2-CH_2-CH(NH_2)-COOH$), ß-Asp ($-CO-CH_2-CH(NH_2)-COOH$), α-Glu ($-CO-CH(NH_2)-CH_2-CH_2-COOH$), or α-Asp ($-CO-CH(NH_2)-CH_2-COOH$). An "uncommon" or nonstandard amino acid is a derivative of one of the 20 standard amino acids that occur in biological systems; some occur as components of proteins occurring in nature, some are biologically active peptides.

A compound of formula I may be present in the form as shown or in its ionic form with or without a counter-ion, for example its sodium, potassium, calcium, ammonium, chloride, sulphate, phosphate, carbonate salt, or similar.

In another aspect, the invention is directed to the use as a flavour of a compound of formula I wherein R^3 is a residue selected from the group consisting of H, γ-Glu, ß-Asp, α-Glu, α-Asp.

In another aspect, the invention is directed to the use as a flavour of a compound of formula I wherein R^3 is a residue selected from the group consisting of a residue of γ-Glu, ß-Asp.

In another aspect, the invention is directed to the use as a flavour of a compound of formula I wherein X is H.

In another aspect, the invention is directed to the use as a flavour of a compound of formula I wherein R^1 is CH_2SH.

In another aspect, the invention is directed to the use as a flavour of a compound of formula I wherein X is CH_3.

In another aspect, the invention is directed to the use as a flavour of a compound of formula I wherein R1 is $CH_2CH_2SCH_3$.

In another aspect, the invention is directed to the use as a flavour of a compound of formula I wherein R^2 is a residue selected from -C_1-C_5 linear or branched alkoxy residue selected from the group consisting of -O-CH_3, -O-CH_2-CH_3, -O-$CH_2CH_2CH_3$, -O-CH_2CH_2 CH_2CH_3, -O-CH_2CH_2 CH_2 CH_2 CH_3, -O-$CH(CH_3)CH_3$, -O-$CH_2CH(CH_3)_2$, -O-$CH_2CH(CH_3)(CH_2CH_3)$, and -O-$CH_2CH_2CH(CH_3)_2$.

In another aspect, the invention is directed to the use as a flavour of a compound of formula I wherein R^2 is a residue selected from -C_1-C_4 linear or branched alkoxy residue including -O-CH_3, -O-CH_2-CH_3, -O-$CH_2CH_2CH_3$, -O-$CH(CH_3)CH_3$, and -O-$CH_2CH(CH_3)_2$.

In another aspect, the invention is directed to the use as a flavour of a compound of formula I wherein the compound is selected from the group consisting of Cys-O-CH_3, Cys-O-C_2H_5, Cys-O-$CH_2CH_2CH_3$, Cys-O- $CH(CH_3)CH_3$, Met-O-CH_3, Met-O-C_2H_5, γ-Glu-Cys-O-CH_3, , γ-Glu-Cys-O-C_2H_5.

The table below shows a number of example compounds of formula I:

Formula I compound	R^1	R^2	R^3
Cys-O-CH_3	CH_2SH	O-CH_3	H
Cys-O-C_2H_5	CH_2SH	O-CH_2CH_3	H
Cys-O-C_3H_7	CH_2SH	O-$CH_2CH_2CH_3$	H
Cys-O-C_3H_7	CH_2SH	O- $CH(CH_3)CH_3$	H
Met-O-CH_3	$CH_2CH_2SCH_3$	O-CH_3	H
Met-O-C_2H_5	$CH_2CH_2SCH_3$	O-CH_2CH_3	H
γ-Glu-Cys-O-CH_3	CH_2SH	O-CH_3	$COCH_2CH_2CH(NH_2)COOH$
γ-Glu-Cys-O-C_2H_5	CH_2SH	O-CH_2CH_3	$COCH_2CH_2CH(NH_2)COOH$

Table 1 Example compounds according to Formula I

Compounds of formula I display the desired onion note over a wide range of pH.

Some of the compounds of formula I are novel. Therefore, in another aspect, the invention is directed to compounds of formula I, with the proviso that the compounds are not selected from the group consisting of compounds wherein R^1 =CH_2SH, R^2 =OCH_3, and R^3 = H, Cys or γ-Glu; R^1 =CH_2SH, R^2 = OCH_2CH_3, and R^3 = H, Cys, Ala, Gly or γ-Glu; R^1 =CH_2SH, R^2 = $OCH_2CH_2CH_3$, and R^3 = H ; R^1 =CH_2SH, R^2 = $OCH_2CH_2CH(CH_3)_2$, and R^3 = H ; R^1 =CH_2SH, R^2 = $OCH_2CH(CH_3)(CH_2CH3)$, and R^3 = H ; R^1 =CH_2SH, R^2 = $OCH_2CH(CH_3)_2$, and R^3 = H ; R^1 =CH_2SH, R^2 = $OCH(CH_3)CH_3$, and R^3 = H ; R^1 =CH_2SCH_3, R^2 = OCH_3, and R^3 = H, Gly, Phe, or α-Asp ; R^1 =CH_2SCH_3, R^2 = OCH_2CH_3, and R^3 = H, or Gly ; R^1 =CH_2CH_2SH, R^2 = OCH_3, and R^3 = H; R^1 =CH_2CH_2SH, R^2 = OCH_2CH_3, and R^3 = H; R^1 =CH_2CH_2SH, R^2 = $OCH_2CH_2CH_3$, and R^3 = H; R^1 =CH_2CH_2SH, R^2 = $OCH(CH_3)CH_3$, and R^3 = H; R^1 =$CH_2CH_2SCH_3$, R^2 = OCH_3, and R^3 = H, Ser, Gly, Phe, Leu, Met, or α-Asp; R^1 =$CH_2CH_2SCH_3$, R^2 = OCH_2CH_3, and R^3 = H, Met, Phe, or β-Ala; R^1 =$CH_2CH_2SCH_3$, R^2 = $OCH_2CH_2CH_3$, and R^3 = H; R^1 =$CH_2CH_2SCH_3$, R^2 = $OCH_2CH(CH_3)_2$, and R^3 = H; R^1 =$CH_2CH_2SCH_3$, R^2 = $OCH(CH_3)CH_3$, and R^3 = H; R^1 =$CH_2CH_2SCH_3$, R^2 = $OCH_2CH_2CH(CH_3)_2$, and R^3 = H; R^1 =$CH_2CH_2CH_2SH$, R^2 = OCH_3, and R^3 = H; and R^1 =CH_2CH_2 CH_2SCH_3, R^2 = OCH_3, and R^3 = H.

In another aspect, the invention is directed to flavour compositions comprising one or more compounds of formula I as hereinabove defined.

In another aspect, the invention is directed to consumables comprising one or more compounds of formula (I) as hereinabove defined, or mixtures thereof, in a concentration of 1 to 25.000 ppm (weight/weight). A useful concentration is, for example, a concentration from 0.1 - 50 mmol/L, or 0.5 -20 mmol/L, 1 – 10 mmol/L.

In another aspect, the invention is directed to a method for imparting an onion flavour to a consumable, comprising the addition of a compound as hereinabove described to a consumable in an amount sufficient to impart an onion taste. The compound may be added in form of an unpurified reaction mixture in which it was formed, in form of an extract from a plant or fermentation, in form of a crude extract of the above-mentioned, or in purified form.

In another aspect, the invention is directed to a method for imparting a onion flavour and a kokumi taste to a consumable, comprising the addition of a compound of formula I as defined in claim I wherein R^3 = γ-Glu to a consumable.

"Kokumi" is a term used in the flavour industry to describe characteristics such as continuity, mouthfulness, richness and thickness. In contrast thereto, the sensory terms for the basic tastes are salty, sweet, sour, bitter or umami, the latter being the taste of monosodium glutamate (MSG). Kokumi is a distinct taste quality, or rather a taste enhancing quality, which can be easily detected and differentiated with sensory tests by a trained panel. Compounds that provide a kokumi taste are usually tasteless in water, but enhance the taste in combination with other tastants in respect of the above-mentioned qualities.

In methods according to the invention, the compound may be added in the form of an unpurified enzymatic reaction mixture in which it was formed, in the form of a crude extract of such a mixture, or in purified form.

Compounds for use in the present invention may be prepared according to procedures well known in the art.

Certain compounds of formula I can also be prepared enzymatically using gamma-glutamyl-transpeptidase enzyme (GGTP) as is well known in the art using enzymes from various sources including commercial sources and described previously, for example, by Suzuki et al., J. Mol. Catal. 1999, B6, 175-184; Suzuki et al., J. Agric. Food Chem. 2002, 50, 313-318), Suzuki et al.; J. Agric. Food Chem.; 52 (2004); 577-580; Strumeyer and Bloch, Biochem. Prep. 1962, 9, 52-55; Thompson and Meister, Proc. Nat. Acad. Sci. USA, 1975, 72, 1985-1988; Allison and Meister, J. Biol. Chem. 1981, 256, 2988-2992; Meister, The Enzymes B(Academi, New York), 3rd. Ed., Vol. 10, pp. 671-697; Strumeyer and Bloch, J. Biol. Chem. 1969, 235, 27; Thompson and Meister, Proc. Nat. Acad. Sci. USA, 1975, 72, 1985-1988; Oppenheimer et al., J. Biol. Chem. 1979, 254, 5184-5190; Tate and Meister, J. Biol. Chem., 1975, 250, 4619-4627.

Starting materials and the enzymes are readily available commercially or can be obtained as described in the references indicated above. Another possibility is the chemical synthesis of peptides from amino acids, which is well known in the art.

The formed products may be purified and used as a flavour in purified form, or they may be used as a flavour in crude form (enzymatic reaction mixture) or as a crude extract from fermentation or from enzymatic reaction with the isolated enzyme.

If so desired, the product may be purified as follows: lyophilisation, followed by chromatographic work-up, for example gel permeation chromatography may be employed. Chromatography may be performed, for example, with

Sephadex G-10 (Amersham Bioscience, Uppsalla, Sweden) as stationary and water as mobile phase. The effluent is monitored, for example using an UV-detector at 220 nm. The product eluate can be confirmed by analytical methods well known in the art, for example by liquid chromatography and mass spectrometry (LC-MS) and nuclear magnetic resonance (NMR) spectroscopy.

A compound for use in the present invention imparts an onion taste to consumables. The term "consumables" as used herein includes food products, beverages, and compositions for admixture to such products, in particular flavour compositions. Flavour compositions may be added to processed foods or beverages during their processing, or they may actually be consumables in their own right, e.g. condiments such as sauces and the like.

A compound for use in the present invention or a mixture thereof may be used as a flavour ingredient in flavour compositions. A compound or mixture of compounds may be blended with other flavour ingredients in said compositions. A compound or mixture of compounds imparts an onion taste to all kinds of consumables, and is particularly interesting in savoury consumables.

Examples of consumables include cereal products, baker's products, bread products, yeast products, salt and spice products, mustard products, vinegar products, sauces (condiments), soups, processed foods, cooked fruits and vegetable products, meat and meat products, egg products, milk and dairy products, cheese products, butter and butter substitute products, milk substitute products, soy products, edible oils and fat products, medicaments, beverages, alcoholic drinks, beers, soft drinks, food extracts, plant extracts, meat extracts, condiments, sweeteners, nutraceuticals, tablets, lozenges, drops, emulsions, elixirs, syrups and other preparations for making beverages, instant beverages and effervescent tablets.

The flavourant qualities of compounds of the formula (I) may be evident over a broad range of concentrations. For example, in the case of a food or beverage product, a compound or mixture of compounds may be present in a concentration ranging from , for example, 1 to 10.000 ppm, 5 to 25.000 ppm, 10 to 10.000 ppm, 50 to 5000 ppm, and 100 to 1000 ppm (based on weight). The skilled person will appreciate that the appropriate concentration will depend on the consumable, the presence of other flavours, and the desired flavour intensity. The concentration can easily be adjusted by the skilled person to the desired effect.

A person skilled in the art will appreciate that formulations and consumables may contain additional ingredients which may comprise various additives and excipients well known in the art, including anti-caking agents, anti-foaming agents, anti-oxidants, binders, colorants, diluents, disintegrants, emulsifiers, encapsulating agents or formulations, enzymes, fats, flavour-enhancers, flavouring agents, gums, lubricants, polysaccharides, preservatives, proteins, solubilisers, solvents, stabilisers, sugar-derivatives, surfactants, sweetening agents, vitamins, waxes, and

the like. Solvents which may be used are known to those skilled in the art and include e.g. ethanol, ethylene glycol, propylene glycol, glycerin, triacetin, diethyl phthalate and dimethyl phthalate. Encapsulants and gums include maltodextrin, gum arabic, alginates, gelatin, modified starch, and polysaccharides. Examples of additives, excipients, carriers, diluents or solvents for flavour or fragrance compounds may be found e.g. in „Perfume and Flavor Materials of Natural Origin„, S. Arctander, Ed., Elizabeth, N.J., 1960; in "Perfume and Flavor Chemicals", S. Arctander, Ed., Vol. I & II, Allured Publishing Corporation, Carol Stream, USA, 1994; in "Flavourings", E. Ziegler and H. Ziegler (ed.), Wiley-VCH Weinheim, 1998, and "CTFA Cosmetic Ingredient Handbook", J.M. Nikitakis (ed.), 1st ed., The Cosmetic, Toiletry and Fragrance Association, Inc., Washington, 1988.

There now follows a series of non-limiting examples that serve to illustrate the invention.

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Examples 1- 5

Unless otherwise indicated, all sensory tests are triangle tests and are performed according to the guidelines in "Amtliche Sammlung von Untersuchungsverfahren nach § 35 LMBG (Lebensmittel- und Bedarfsgegenständegesetz)"; L 00.90 7 , Untersuchung von Lebensmitteln , Sensorische Prüfverfahren, Dreiecksprüfung (Übernahme der gleichnahmigen Deutschen Norm DIN ISO 4120, Ausgabe Januar 1995), as follows:

The sensory panel is trained to evaluate the taste of aqueous solutions (4 ml each) of the following standard taste compounds by using a triangle test as described in the literature (Wieser and Belitz, Z. Lebensm. Unters. Forsch., **1975**, 159, 65-72): sucrose (40 mmol/L) for sweet taste; citric acid (5 mmol/L) for sour taste; NaCl (12 mmol/L) for salty taste; caffeine (2 mmol/L) for bitter taste; and monosodium glutamate (MSG; 6 mmol/L) for umami taste. For kokumi taste, a solution of glutathione (10 mmol/L) in diluted chicken broth concentrate (Gourmet Bouillon Huhn, Maggi, Singen, Germany; 3 g/100 g bottled water (Evian®)) is prepared and compared to the taste of chicken broth with no glutathione added. All sensory analyses are performed in a sensory panel room at 22-25 °C over three different sessions by a trained panel of 8 to 10 individuals.

For recording the taste profiles, samples are prepared as indicated in the examples below. Taste profiles of samples are determined in a triangle test in three different sessions. Panellists refrain from eating or drinking for at least 1 hour prior to the session. At the start of the session and before each trial, the subject rinsed with water and expectorated. The participants receive a set of two blanks and one taste sample. Liquid samples are swirled around in the mouth briefly and expectorated. Solid samples are chewed for 20 seconds and then expectorated. After indicating, which glass vial shows a different taste profile and description of the distinction, the participant receives another trial set of two blanks and one taste sample. Each sample with additive is compared to two reference samples without additives.

The sample compounds of formula I with their corresponding residues are listed below:

Compounds of formula I	**R1**	**R2**	**R3**
Cys-O-CH_3	CH_2 SH	OCH_3	H
Cys-O-C_2H_5	CH_2 SH	OC_2H_5	H
Met-O- CH_3	CH_2 CH_2 S CH_3	OCH_3	H
Met-O- C_2H_5	CH_2 CH_2 S CH_3	OC_2H_5	H
γ-Glu-Cys-O- C_2H_5	CH_2 SH	OC_2H_5	γ-Glu

Example 1

Sensory effects of compounds of formula I in water

Samples	Concentration of additive	Onion flavour intensity	Sensory description
Cys-OH	5 mmol/L	0	sweet
Met-OH	5 mmol/L	0	sweet
γ-Glu-Cys-OH	5 mmol/L	0	tasteless
Ser-O-C_2H_5	5 mmol/L	0	slightly sweet
Ser-O-CH_3	5 mmol/L	0	slightly sweet
γ-Glu-Cys-Gly- O-C_2H_5	5 mmol/L	0	intensely bitter
γ-Glu-Cys(S-C_2H_5)-Gly- O-C_2H_5	5 mmol/L	0	intensely bitter
Cys-O-CH_3	5 mmol/L	2,5	onion flavour
Cys-O-C_2H_5	5 mmol/L	3,5	onion flavour
Met-O- CH_3	5 mmol/L	1	slight onion flavour
Met-O- C_2H_5	5 mmol/L	1,5	slight onion flavour
γ-Glu-Cys-O- C_2H_5	5 mmol/L	4,5	onion flavour

Example 2

Sensory effects of compounds of formula I in chicken broth

Sensory tests (triangle test) are performed at least three times for each compound using sensory panels of different individuals to confirm results.

Chicken Broth is prepared by dilution of 3 g chicken broth concentrate (Gourmet Bouillon Huhn; Maggi, Singen, Germany) with 100 ml water (Evian). Additives are added as specified in table below.

The pH-value of all samples is adjusted to 6.5 using formic acid (0.1 mol/L) or sodium hydroxide (0.1 mol/L).

Flavour intensity (onion or kokumi) is rated from 0-5 according to a scale from 0 to 5 (with 5 most intensive). GSH (5 mmol/L) is determined to have an kokumi intensity of 3 in all tests.

The additive is added to a consumable and the sample is homogenised. The samples are presented to the sensory panel directly after homogenisation.

The results of the tests are indicated in the table below. For each sample, flavour intensity is rated and panelists are asked to describe sensory characteristics.

Chicken broth samples	concentration of additive	onion flavour intensity (0-5)	kokumi intensity (0-5)	Sensory descriptors
Negative control (without additives)	-	0	2	-
Positive control: NaCl	30 mmol/L	0	2	increased salt taste
Positive control: MSG (mono sodium glutamate)	10 mmol/L	0	2	increased umami taste
Cys-OH	5 mmol/L	0	2	increased sweetness
GSH, reduced form [γ-Glu-Cys-Gly]	5 mmol/L	0	3	increased kokumi taste (complexity and mouthfulness, more rich, more impact, punch)
γ-Glu-Cys-OH	5 mmol/L	0	4	increased kokumi taste (complexity and mouthfulness, more rich, more impact, punch)
Cys-O-CH_3	5 mmol/L	2	2	onion flavour
Cys-O-C_2H_5	5 mmol/L	3	2	onion flavour
Met-O-CH_3	5 mmol/L	0,5	2	slight onion flavour
Met-O-C_2H_5	5 mmol/L	1,5	2	slight onion flavour
γ-Glu-Cys-O-C_2H_5	5 mmol/L	4	3,5	strong onion flavour, increased kokumi taste (complexity and mouthfulness), more impact, punch, long lasting taste sensation

Example 3

Onion flavour compounds in tomato soup

Cys-O-C_2H_5 and γ-Glu-Cys-O-C_2H_5 are added to tomato soup (Unox, Unilever Bestfoods, Germany, pH 4,5), in the concentrations indicated below.

Tomato soup samples	Test results
Reference without additives	-
Cys-O-C_2H_5 (1 mmol/L)	Preferred, onion like flavour, slightly meaty
Cys-O-C_2H_5 (5 mmol/L)	Preferred, onion like flavour, meaty, stronger than the effect found for Cys-O-C_2H_5 (1 mmol/L)
γ-Glu-Cys-O-C_2H_5 (1 mmol/L)	Preferred, onion like flavour, meaty, roasty, slightly increased complexity and mouthfulness, more impact, punch, long lasting taste sensation
γ-Glu-Cys-O-C_2H_5 (5 mmol/L)	Preferred, strong onion like flavour, meaty, roasty, more pronounced when compared to Cys-O-C_2H_5 (5 mmol/L), increased complexity and mouthfulness, more impact, punch, long lasting taste sensation

All panellists find samples 2-5 different from the reference sample and preferred. The samples Cys-O-C_2H_5 (1 mmol/L) and Cys-O-C_2H_5 (5 mmol/L) both are described to possess a onion like and slightly meaty flavour, γ-Glu-Cys-O-C_2H_5 (1 mmol/L) and γ-Glu-Cys-O-C_2H_5 (5 mmol/L) are additionally described as more roasty. Samples containing γ-Glu-Cys-O-C_2H_5 possess also a kokumi taste, panellists characterized the samples having a more complex, long lasting taste sensation and an increased mouthfulness.

Example 4

Onion flavour compounds in mushroom cream soup

Cys-O-C_2H_5 and γ-Glu-Cys-O-C_2H_5 are added to mushroom cream soup (Unox, Unilever Bestfoods, Germany), pH 6.0 in a concentration of 1 mmol/L samples are evaluated directly after homogenisation.

samples	Test results
Reference without additives	-
Cys-O-C_2H_5	Preferred, onion like flavour
γ-Glu-Cys-O-C_2H_5	Preferred, strong onion like flavour, meaty, roasty, more pronounced when compared to Cys-O-C_2H_5, increased complexity and mouthfulness, more impact, punch, long lasting taste sensation

Cys-O-C_2H_5 is indicated by 7 out of 8 panelists to have a onion like flavour. γ-Glu-Cys-O-C_2H_5 is described similar to Cys-O-C_2H_5, but the observed effect is higher and the sample elicits a more complex, long lasting taste.

Example 5

Onion flavour compounds in barbecue sauce

Onion flavour compounds as indicated in the table below are added to barbecue sauce (Kraft Foods, Germany), pH 3,3.

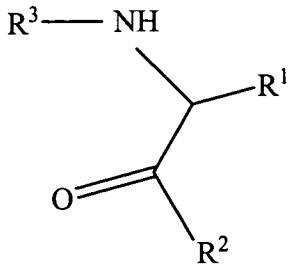
samples	Test results
Reference without additive	-
Cys-O-C_2H_5 (5 mmol/L)	Preferred, onion like flavour, meaty
γ-Glu-Cys-O-C_2H_5 (5 mmol/L)	Preferred, strong onion like flavour, meaty, roasty, more pronounced when compared to Cys-O-C_2H_5 (5 mmol/L), increased complexity and mouthfulness, more impact, punch, long lasting taste sensation

Both samples with additive are significantly preferred and described to have onion like and slightly meaty flavour, samples containing γ-Glu-Cys-O-C_2H_5 are additionally described as more roasty. This sample possesses also a kokumi taste, panellists characterized the sample having a more complex, long lasting taste sensation and an increased mouthfulness.

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Claims:

1. Use as a flavour of at least one compound according to the formula (I), or a salt thereof,



I

wherein the residues R^1, R^2 and R^3 are selected as follows:

R^1 is a residue selected from the group consisting of $-CH_2SX$, $-CH_2CH_2SX$, and $-CH_2CH_2CH_2SX$, with X being a residue selected from H and $-CH_3$;

R^2 is a residue selected from $-C_1-C_5$ linear or branched alkoxy residue including $-O-CH_3$, $-O-CH_2-CH_3$, $-O-CH_2CH_2CH_3$, $-O-CH_2CH_2\ CH_2CH_3$, $-O-CH_2CH_2\ CH_2\ CH_2\ CH_3$, $-O-CH(CH_3)CH_3$, $-O-CH_2CH(CH_3)_2$, $-O-CH_2CH(CH_3)(CH_2CH_3)$, and $-O-CH_2CH_2CH(CH_3)_2$; and

R^3 is a residue selected from the group of H, and an aminoacid residue linked via a peptide bond selected from the group consisting of γ-Glu ($-CO-CH_2-CH_2-CH(NH_2)-COOH$), ß-Asp ($-CO-CH_2-CH(NH_2)-COOH$), α-Glu ($-CO-CH(NH_2)-CH_2-CH_2-COOH$), α-Asp ($-CO-CH(NH_2)-CH_2-COOH$), β-Ala ($-CO-\ CH_2-\ CH_2-NH_2$), α-Ala, α-Val, α-Leu, α-Ile, α-Met, α-Pro, α-Phe, α-Trp, α-Ser, α-Thr, α-Asn, α-Gln, α-Tyr, α-Cys, α-Lys, α-Arg, α-His, α-Asp, a gamma amino butyric acid (GABA), and an uncommon amino acid including 4-hydroxyprolin, ε-N,N,N-trimethyllysine, 3-methylhistindine, 5-hydroxylysine, O-phosphoserine, gamma-carboxyglutamate, ε-N-acetyllysine, ω-N-methylarginine, N-acetylserine, N,N,N-trimethylalanine, N-formylmethionine.

2. Use according to claim 1 wherein R^3 is a residue selected from the group consisting of H, γ-Glu, ß-Asp, α-Glu, α-Asp.

3. Use according to claim 1 wherein R^3 is a residue selected from the group consisting of a residue of γ-Glu, ß-Asp.

4. Use according to claim 1 wherein X is H.

5. Use according to claim 4 wherein R1 is CH_2SH.

6. Use according to claim 1 wherein X is CH_3.

7. Use according to claim 6 wherein R1 is CH_2 CH_2SCH_3.

8. Use according to claim 1 wherein R^2 is a residue selected from -C_1-C_5 linear or branched alkoxy residue selected from the group consisting of -O-CH_3, -O-CH_2-CH_3, -O-$CH_2CH_2CH_3$, -O-CH_2CH_2 CH_2CH_3, -O-CH_2CH_2 CH_2 CH_2 CH_3, -O-$CH(CH_3)CH_3$, -O-$CH_2CH(CH_3)_2$, -O-$CH_2CH(CH_3)(CH_2CH_3)$, and -O-$CH_2CH_2CH(CH_3)_2$.

9. Use according to claim 1 wherein R^2 is a C_1-C_4 linear or branched alkoxy residue including -O-CH_3, -O-CH_2-CH_3, -O-$CH_2CH_2CH_3$, -O-$CH(CH_3)CH_3$, and -O-$CH_2CH(CH_3)_2$.

10. Use according to claim 1 wherein the compound is selected from the group consisting of Cys-O-CH_3, Cys-O-C_2H_5, Cys-O-C_3H_7, Cys-O-C_3H_7, Met-O-CH_3, Met-O-C_2H_5, γ-Glu-Cys-O-CH_3, , γ-Glu-Cys-O-C_2H_5.

11. A compound as defined in formula I of claim 1, with the proviso that the compounds are not selected from the group consisting of compounds wherein R^1 =CH_2SH, R^2 =OCH_3, and R^3 = H, Cys or γ-Glu; R^1 =CH_2SH, R^2 = OCH_2CH_3, and R^3 = H, Cys, Ala, Gly or γ-Glu; R^1 =CH_2SH, R^2 = $OCH_2CH_2CH_3$, and R^3 = H ; R^1 =CH_2SH, R^2 = $OCH_2CH_2CH(CH_3)_2$, and R^3 = H ; R^1 =CH_2SH, R^2 = $OCH_2CH(CH_3)(CH_2CH3)$, and R^3 = H ; R^1 =CH_2SH, R^2 = $OCH_2CH(CH_3)_2$, and R^3 = H ; R^1 =CH_2SH, R^2 = $OCH(CH_3)CH_3$, and R^3 = H ; R^1 =CH_2SCH_3, R^2 = OCH_3, and R^3 = H, Gly, Phe, or α-Asp ; R^1 =CH_2SCH_3, R^2 = OCH_2CH_3, and R^3 = H, or Gly ; R^1 =CH_2CH_2SH, R^2 = OCH_3, and R^3 = H; R^1 =CH_2CH_2SH, R^2 = OCH_2CH_3, and R^3 = H; R^1 =CH_2CH_2SH, R^2 = $OCH_2CH_2CH_3$, and R^3 = H; R^1 =CH_2CH_2SH, R^2 = $OCH(CH_3)CH_3$, and R^3 = H; R^1 =$CH_2CH_2SCH_3$, R^2 = OCH_3, and R^3 = H, Ser, Gly, Phe, Leu, Met, or α-Asp; R^1 =$CH_2CH_2SCH_3$, R^2 = OCH_2CH_3, and R^3 = H, Met, Phe, or β-Ala; R^1 =$CH_2CH_2SCH_3$, R^2 = $OCH_2CH_2CH_3$, and R^3 = H; R^1 =$CH_2CH_2SCH_3$, R^2 = $OCH_2CH(CH_3)_2$, and R^3 = H; R^1 =$CH_2CH_2SCH_3$, R^2 = $OCH(CH_3)CH_3$, and R^3 = H; R^1 =$CH_2CH_2SCH_3$, R^2 = $OCH_2CH_2CH(CH_3)_2$, and R^3 = H; R^1 =$CH_2CH_2CH_2SH$, R^2 = OCH_3, and R^3 = H; and R^1 =CH_2CH_2 CH_2SCH_3, R^2 = OCH_3, and R^3 = H.

12. A flavour composition comprising one or more compounds of formula I as defined in any one of claims 1 to 11, or a mixture thereof.

13. A consumable containing one or more compounds of formula (I) as defined in any one of claims 1 to 11, or mixtures thereof, in a concentration of 1 to 25.000 ppm (weight/weight).

14. A method for imparting a onion flavour to a consumable, comprising the addition of one or more compounds as defined in any one of claims 1 to 11 to a consumable.

15. A method for imparting a onion flavour and a kokumi taste to a consumable, comprising the addition of a compound of formula I as defined in claim 1 wherein R^3 is γ-Glu to a consumable.

16. Method according to claim 14 or 15 wherein the compound is added in form of an unpurified reaction mixture in which it was formed, in form of an extract from a plant or fermentation, in form of a crude extract of the above-mentioned, or in purified form.