Flavor Properties of FEMA GRAS List 25 Flavor Chemicals[a]

A preliminary assessment

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[a] *www.femaflavor.org/uploadedfiles/GRAS_25_Tables.pdf*

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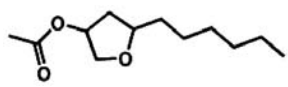
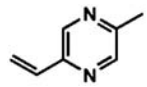
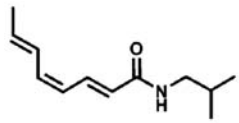
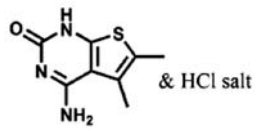
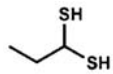
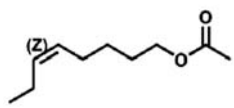
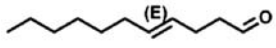
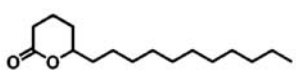
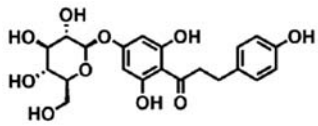
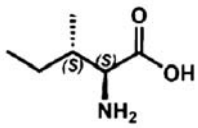
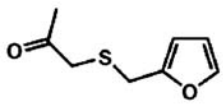
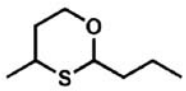
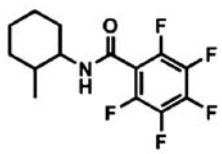
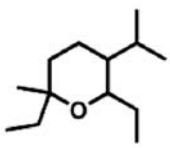
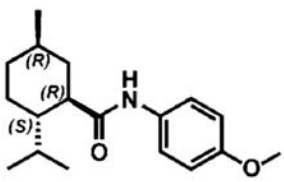
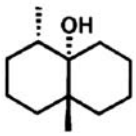
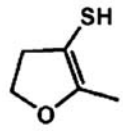
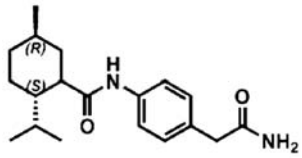
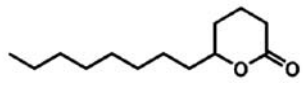
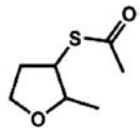
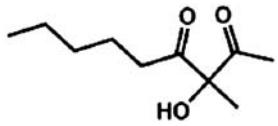
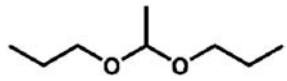
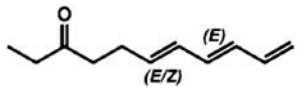
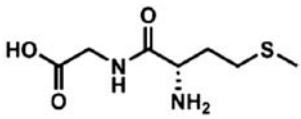
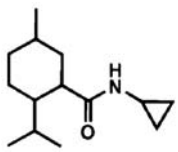
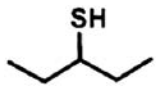
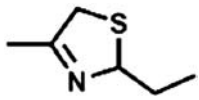
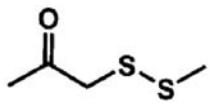
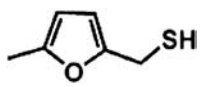
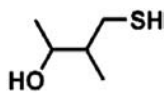
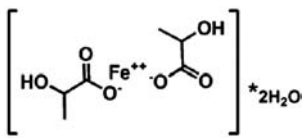
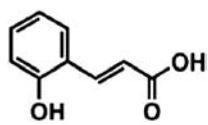
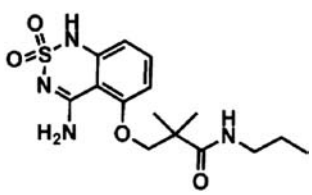
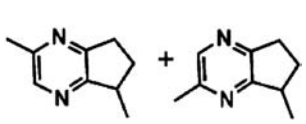
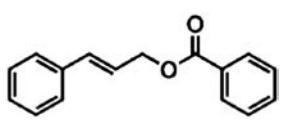
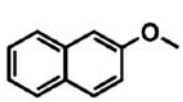
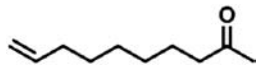
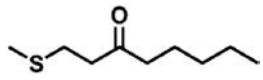
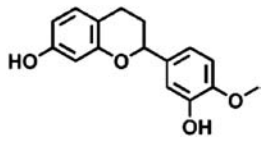
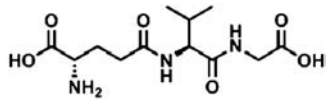
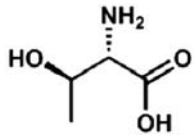
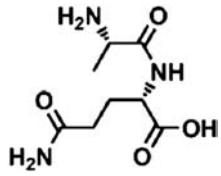
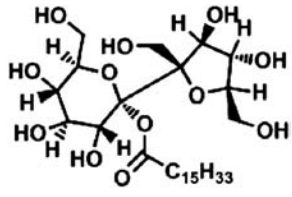
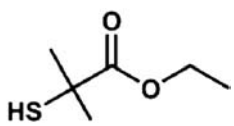
This author welcomes additional insights and descriptors for these materials.

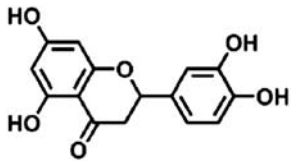
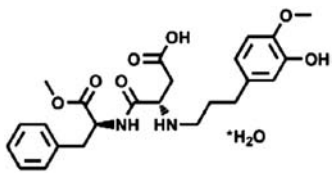
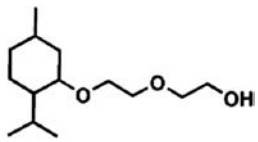
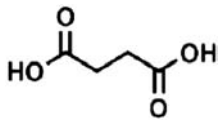
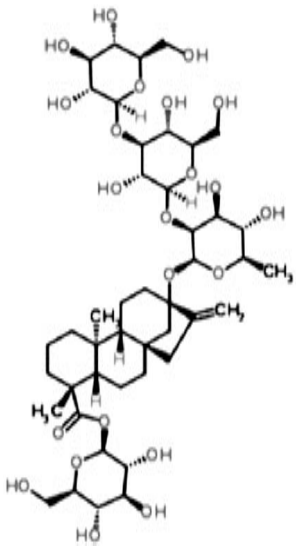
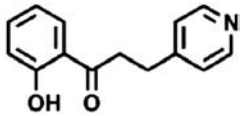
FEMA# / CAS#	Name	Description	Structure
2566 / 10039-39-1	2-Hexyl-4-acetoxytetrahydrofuran (Re-GRAS)	Sweet, floral-fruity odor with a peach-apricotlike taste.	
3211 / 13925-08-1	2-Methyl-5-vinylpyrazine (Re-GRAS)	Coffeelike @ 10 ppm in sugar syrup.[1]	
4668 / 25394-57-4	Spilanthol; Affinin; (2E,4Z,6E)-N-isobutylocta-2,4,6-trienamide	Imparts salivation, tingling effects, numbing effects and is perceived as salty by most persons. A flavor enhancer.[2–4]	
4669 / 121746-18-7	4-Amino-5,6-dimethylthieno[2,3-d] pyrimidin-2(1H)-one & hydrochloride salt	Sweetness enhancer and modulator, especially for sucralose.[5]	
4670 / 88497-17-0	1,1-Propanedithiol	Sulfurous, powerful cooked onion savory odor.	
4671 / 71978-00-2	(Z)-5-Octenyl acetate	Odor: Banana tissuelike, melonlike, green, coarse, fruit fleshlike, fermented. Taste in water: Bananalike, melonlike, estery, juicy, pineapplelike, green, fruit fleshlike (at 2.5 ppm).[6]	
4672 / 68820-35-9	(E)-4-Undecenal; *trans*-4-Undecenal	Fatty, aldehydic with floral, herbaceous, and some citrus notes.	
4673 / 7370-44-7	δ-Hexadecalactone	Mild, fatty waxy, mild dairy notes; adds buttery notes/mouthfeel in cream.[7] delta-Hexadecalactone provided a fatty mouthfeel to an o/w emulsion (threshold = 190 micromol/L) and a melted butterlike aroma in whipped cream (recognition threshold in whipped cream = 360 micromoles per kilogram).	

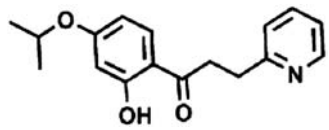
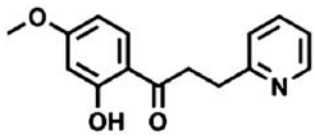
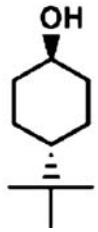
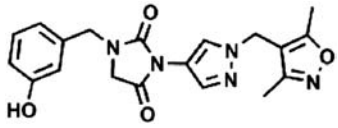
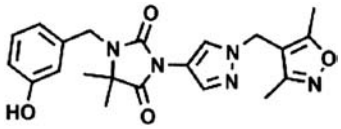
FEMA# / CAS#	Name	Description	Structure
4674 / 4192-90-9	Trilobatin; 1-[4-(b-D-glucopyranosyloxy)-2,6-dihydroxyphenyl]-3-(4-hydroxyphenyl)-1-propanone	Sweetness enhancer and bitter blocker.[8,9]	
4675 / 73-32-5	L-Isoleucine	Essentially odorless; used in reaction flavors and as a nutritional supplement.	
4676 / 58066-86-7	1-(2-Furfurylthio)-2-propanone	Burnt coffee note at 10 ppm in sugar syrup; cabbage at 3 ppm; mercaptan note at 6.7 ppm in coffee.[10,11]	
4677 / 1064678-08-5	(±)-4-Methyl-2-propyl-1,3-oxathiane	Odor @ 0.5%: Onion, garlic, powerful, sweet. Flavor profile: Pineapple, milky, mango, grapey, citrus, bubblegum, melon, orange flower, cassis, alliaceous, bacon (extremely strong).[12]	
4678 / 1003050-32-5	N-(2-Methylcyclohexyl)-2,3,4,5,6-pentafluorobenzamide	Artificial sweetener; sweetness enhancer for sucrose.[13]	
4680 / 1120363-98-5	5-Isopropyl-2,6-diethyl-2-methyltetrahydro-2H-pyran	Imparts a breath freshening effect.[14] In a particular embodiment the invention relates to the use of these flavoring substances in flavoring substance and flavoring compositions with a freshening effect for use in oral hygiene products. A preferred compound for achieving the object of the invention is 2,6-diethyl-5-isopropyl-2-methyltetrahydropyran.	
4681 / 68489-09-8	WS-12; (1R,2S,5R)-N-(4-Methoxyphenyl)-p-menthanecarboxamide	WS-12 is one of the original Wilkinson Sword cooling agents and is reported to be as cooling as the WS-3 compound. (Cooling strength of 150 as compared to (-)-menthol at 100).[15] More recently, Furrer et al. indicated that in isointensity measurements vs 2 ppm menthol, WS-12 was essentially the same cooling strength as menthol.[16]	
4682 / 16423-19-1	Geosmin	Intense earthy-musty; green, herbal note in dilution.	

FEMA# / CAS#	Name	Description	Structure
4683 / 26486-13-5	2-Methyl-4,5-dihydrofuran-3-thiol	Sulfurous, roasted meat, savory on dilution.[17]	
4684	(2S,5R)-N-[4-(2-Amino-2-oxoethyl)phenyl]-p-menthanecarboxamide	At a level of 10 ppm in water this material contributes moderate throat and mouth cooling that lingers with some bitter notes in the background. Cooling lasts within the breath for 30 minutes. At the level of 1 ppm in water it is clean with slight cooling up front that builds with time to moderate level. Cooling lasted for 30 minutes.[18]	
4685 / 7370-92-5	δ-Tridecalactone	Fatty, creamy, dairy-butter notes.	
4686 / 252736-41-7	(±)-2-Methyltetrahydrofuran-3-thiol acetate	Sulfurous, roasted meat.	
4687 / 544409-58-7	(±)-3-Hydroxy-3-methyl-2,4-nonanedione	Imparts a creamy/fatty mouthfeel flavor. It is also able to impart an organoleptic impression similar the one of fresh brewed green tea.[19]	
4688 / 105-82-8	1,1-Dipropoxyethane	Fresh ethereal alcoholic, winey-fruity. Like all acetals, it is unstable in aqueous acid media (e.g., beverages) where it reverts to the corresponding aldehyde and alcohols.	
4691 / 1009814-14-5	Yuzunone; (8E)-6,8,10-undecatrien-3-one	Peely, balsamic, floral, a character impact compound of yuzu.[20,21]	
4692 / 14486-03-4	L-Methionylglycine	The dipeptide, L-Methionylglycine, has a rather bland, non-offensive, taste and is generally stable in many applications. As such it can be used as a "stable" nutritional source of methionine, without the off notes normally generated by free methionine.	
4693 / 73435-61-7	N-Cyclopropyl-5-methyl-2-isopropylcyclohexane-carboxamide	Cooling agent. This is the cyclopropyl analog of WS-3 and is mentioned in United States Patent 4150052 as having an oral cooling threshold of 0.5 micrograms as compared to 0.25 micrograms for (-)-menthol.[22] This indicates it has about 50% of the cooling intensity of menthol.	

FEMA# / CAS#	Name	Description	Structure
4694 / 616-31-9	3-Pentanethiol	Sulfurous, offensive mercaptan, gassy, savory, durian notes.	
4695 / 41803-21-8	2-Ethyl-2,5-dihydro-4-methylthiazole	This is an ethyl homolog of 2,4-dimethyl-3-thiazoline that is described as "nutty, roasted, vegetable" and as "sulfurous, roasted and meaty" on dilution.	
4696 / 122861-78-3	1-Methyldithio-2-propanone	Japanese Patent JP01102056 describes this as having an onionic sweet smell and green fragrance, and is useful for foods, cosmetics, hygienic and sanitary goods, toiletry goods, etc.[23]	
4697 / 59303-05-8	5-Methylfurfurylmercaptan	Sulfurous roasted, coffee odor; meaty flavor at 0.5–1.0 ppb.	
4698 / 33959-27-2	4-Mercapto-3-methyl-2-butanol	Sulfurous, onion, savory, meaty notes.	
4699 / 85993-25-5	Ferrous lactate, dihydrate	Normally used as an acidity regulator, a color and color retention agent, and is also used to fortify foods with iron.	
4700 / 614-60-8	*trans*-o-Coumaric acid	Antioxidant and potential nutraceutical; flavor and sweetness modifier. Potentially a nutraceutical; in combination with rutin, it reduces obesity, triglycerides and cholesterol levels in rats.[24]	
4701 / 1093200-92-0	3-(4-Amino-1H-benzo[c][1,2,6]thiadiazin-5-yloxy)-2,2-dimethyl-N-propylpropanamide-2,2-dioxide	This is the sucrose sweetness enhancer of Senomyx.[25]	
38917-61-2 & 38917-62-3	2(3),5-Dimethyl-6,7-dihydro-5H-cyclopentapyrazine (mixture)	Nutty, brown, roasted, burnt, earthy and musty. Covers mix of 2,5-dimethyl-6,7-dihydro-5H-cyclopentapyrazine (60-100%) and 3,5-dimethyl-6,7-dihydro-5H-cyclopentapyrazine (up to 40%).	
4703 / 5320-75-2	Cinnamyl benzoate	Balsamic, sweet, slightly spicy.	
4704 / 93-04-9	β-Naphthyl methyl ether	Intense sweet floral orange blossom odor in dilution.	

FEMA# / CAS#	Name	Description	Structure
4706 / 35194-30-0	9-Decen-2-one	Pineapple, with fruity notes of pear, apple, green and fatty.[26,27]	
4707 / 61837-77-2	1-(Methylthio)octan-3-one	At 5 ppm in water, the flavor is described as oxidized citrus, tomato vine, vegetable peel and blue cheese.[28]	
4708 / 76426-35-2	3',7-Dihydroxy-4'-methoxyflavan	Sweetness enhancer (especially for sucrose) and bitter masking.[29]	
4709 / 38837-70-6	L-γ-Glutamyl-L-valyl-glycine	Tasteless, but a potent kokumi and umami flavor enhancer. Kokumi is a food attribute identified by the Japanese. It is sometimes translated as "heartiness" or "mouthfulness" and describes compounds in food that don't have their own flavor, but enhance the flavors with which they're combined.[30] EP2156752, assigned to Ajinomoto, discloses that L-γ-glutamyl-L-valyl-glycine is also useful in improving the taste of aspartame.[31]	
4710 / 72-19-5	L-Threonine	Pleasantly sweet; used in reaction flavors. Also forms maple furanone (FEMA# 3153) via 2-oxobutyric acid by acid hydrolysis of threonine.[32,33]	
4712 / 26446-38-8	L-Alanyl-L-glutamine	Nutraceutical; in nutritional supplements and sports drinks; slightly sweet. L-alanyl-L-glutamine, among other dipeptides, is extremely stable in solution but is immediately broken down into free amino acids by proteases in the blood stream. Used as an L-glutamine source.	
4713 / 26446-38-8	Sucrose monopalmitate	Sucrose monopalmitate is an emulsifier. In flavor applications, it is useful for producing flavor oil emulsions for "clear beverages."[34,35]	
4714 / 33441-50-8	Ethyl 2-mercapto-2-methylpropionate	This material is closely related to ethyl 2-mercaptopropionate, which is described as "fruity, sulfur, animal, foxy, burnt and pungent."[36]	

FEMA# / CAS#	Name	Description	Structure
4715 / 4049-38-1	Eriodictyol; (±)-eriodictyol	Eriodictyol is a bitter-masking flavanone, a flavonoid extracted from yerba santa (*Eriodictyon californicum*). Eriodictyol is one of the four flavanones identified in this plant as having taste-modifying properties, the other three being homoeriodictyol, its sodium salt and sterubin.[37,38]	
4716 / 714229-20-6	Advantame (N-[N-[3-(3-hydroxy-4-methoxyphenyl) propyl]-L-α-aspartyl]-L-phenylalanine 1-methyl ester) monohydrate	This material is about 20,000 times sweeter than sucrose and is the subject of European Patent EP1070726 (02/20/2008) and United States Patent 6630191 (10/07/2003) by Y. Amino et al. assigned to Ajinomoto.[39–41]	
4718 / 28804-53-7	2-[(2-p-Menthoxy)ethoxy] ethanol	2-[2-(Menthoxy)ethoxy]ethanol is mentioned in United States Patent Application 20100216876 as a cooling agent useful in antidiarrhetic medicinal compositions.[42] However no details on the cooling strength are given.	
4719 / 110-15-6	Succinic acid	Odorless, sour acid taste; flavor, umami and saltiness enhancer.	
4720 / 63550-99-2	Rebaudioside C; dulcoside B; RP44	Redpoint Bio first announced that it had identified RP44, an all-natural sweetness enhancer, in June 2009. RP44 is Reb-C (rebaudioside C), a component of the stevia plant. In June 2010, Redpoint entered into a license and commercialization agreement with International Flavors and Fragrances, Inc., covering the commercialization of RP44. RP44 received FEMA GRAS approval in October 2010. Unlike Reb A, RP44 is not a sweetener; rather, it is a sweetness enhancer. A sweetness enhancer imparts no sweet taste of its own when used in a product. Sweetness enhancers act by amplifying the existing sweet taste of caloric sweeteners such as sugar or high fructose corn syrup.	
4721 / 1186004-10-3	1-(2-Hydroxyphenyl)-3-(pyridine-4-yl)propan-1-one	This material is subject to the claims in United States Patent Application 20100272656 (10/28/2010).[43] It is a sweetness and flavor enhancer.	

FEMA# / CAS#	Name	Description	Structure
4722 / 1190230-47-7	1-(2-Hydroxy-4-isobutoxyphenyl)-3-(pyridine-2-yl)propan-1-one	This material is the subject of WIPO Patent Application WO/2011/004016 (01/13/2011).[44] The taste at 2 ppm in a 0.3% salt solution was described by a panel of 20 women as: umami, sweet, salty, bouillon, lingering and intense.	
4723 / 1190229-37-8	1-(2-Hydroxy-4-methoxyphenyl)-3-(pyridine-2-yl)propan-1-one	This material is the subject of WIPO Patent Application WO/2011/004016 (01/13/2011).[44] The taste at 2 ppm in a 0.3% salt solution was described by a panel of 20 women as umami, sweet, salty, long-lasting savory.	
4724 / 21862-63-5	*trans*-4-tert-Butylcyclohexanol	*trans*-4-tert-Butylcyclohexanol is an antagonist of the heat receptor TRPV1 and thus is useful for reducing "heat sensations."[45] The material also can mitigate the hot sensations of capsaicin. In WIPO Patent Application WO/2010/149798 (12/29/2010), *trans*-4-tert-butylcyclohexanol is shown to be useful for enhancing the cooling effect of cooling agents by inhibiting heat sensations in topical applications.[46] A commercial mixture of ~68% *trans* and ~31% *cis* isomer is described as woody, patchoulilike.	
4725 / 1119831-25-2	3-(1-((3,5-Dimethylisoxazol-4-yl)methyl)-1H-pyrazol-4-yl)-1-(3-hydroxybenzyl)-imidazolidine-2,4-dione	This material is reported as a bitter taste blocker in United States Patent Application 20100254916 (10/07/2010).[47]	
4726 / 1217341-48-4	3-(1-((3,5-Dimethylisoxazol-4-yl)methyl)-1H-pyrazol-4-yl)-1-(3-hydroxybenzyl)-5,5-dimethylimidazolidine-2,4-dione	This material is reported as a bitter taste blocker in United States Patent Application 20100254916 (10/07/2010).[47]	

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