

Citronellyl acetate	NIF	C12H22O2	198.31	floral, rose, fruity, sweet	0	0.02	0.01	NIF	NIF	NIF	NIF	NIF	NIF	Monoterpene	[4], [15], [43]	150-84-5
d-3-Carene	NIF	C10H16	136.23	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Monoterpene	[29]	13466-78-9
d-Cadinene	NIF	C15H24	204.35	NIF	NIF	NIF	>30 ppm	NIF	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[4]	60305-17-1
d-Cadinol	d-Cadinol	C15H26O	222.37	NIF	0.005	0.2	0.103	NIF	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[4], [19], [29], [54], [55]	36564-42-8
Decanal	NIF	C10H20O	156.27	green, wax, floral, fruity	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Aldehyde	[59]	112-31-2
Decanoic acid	NIF	C10H20O2	172.27	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[12], [29], [54]	334-48-5
Decen-2-one	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ketone	[54]	NIF
Diallyl sulphide	NIF	C6H10S2	190.28	garlic-like	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Sulfide	[32]	2179-57-9
Diethyl disulphide	S-Methylthioisovalerate	C4H10S2	122.25	rotting vegetable, onion-like, rubbery, sewage-like, sweat	NIF	NIF	NIF	0.0004	0.025	NIF	NIF	NIF	NIF	Sulfide	[32], [40], [58]	110-81-6
Diethyl sulphide	NIF	C4H10S	90.19	rotting vegetable, onion-like, rubbery, sewage-like	NIF	NIF	NIF	0.0003	0.0012	0.03	NIF	NIF	NIF	Sulfide	[32], [39]	352-93-2
Dihydrojasmane	NIF	C11H18O	166.26	Fruity, sweet, floral, woody with a powdery nuance	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ketone	[43]	1128-08-1
Dimethyl disulfide	DMDS	C2H6S2	94.20	cooked vegetable, onion, rubbery, rotten vegetables, cheesy, glue	0.0001	0.003	0.0016	0.003	0.0075	0.05	NIF	NIF	NIF	Sulfide	[10], [11], [17], [18], [29], [32], [39], [40]	624-92-0
Dimethyl sulfide	DMS, Methyl sulfide	C2H6S	62.13	cooked vegetable (corn, onion), garlic, sweet corn, tin, black currant, sulfur, cooked cabbage, tinned tomato, baked beans	0.005	0.1	0.053	0.001	0.008	0.03	0.00033	NIF	NIF	Sulfide	[1], [2], [3], [4], [5], [8], [9], [11], [16], [17], [19], [21], [22], [23], [28], [32], [39]	75-18-3
Dimethyl sulfide	NIF	C2H6S	62.13	sulfury, cooked vegetable, onion-like	0.005	0.1	0.053	0.05	0.13	NIF	NIF	NIF	NIF	Sulfide		75-18-3
Dimethyl tetrasulfide	NIF	C2H6S4	158.33	sulfury, cooked vegetable, onion-like	NIF	NIF	NIF	0.2	NIF	NIF	NIF	NIF	NIF	Sulfide	[32], [39]	5756-24-1
Dimethyl trisulfide	DMTS, 2,3,4-Trihiapentane, Dimethyltrisulfane	C2H6S3	126.26	onion (soup), rotting fruit, red cabbage, sulfur, rotten vegetables, fresh onion, cooked vegetables	0.00001	0.0008	0.0004	0.000027	0.00005	0.0001	NIF	NIF	NIF	Sulfide	[10], [11], [17], [18], [25], [26], [31], [32], [34], [39], [40], [60]	3658-80-8
Dimethylallyl methyl sulfide	NIF	C6H12S	117.09	garlic, rubbery, onion	NIF	NIF	NIF	0.0002	NIF	NIF	NIF	NIF	NIF	Sulfide	[10], [18]	NIF
Dodecanal	NIF	C12H24O	184.32	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Aldehyde	[59]	112-54-9
Dodecanoic acid	NIF	C12H24O2	200.32	NIF	NIF	NIF	0.01	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[39]	26303-90-2
E,Z-2,6-Nonadienal	trans,cis-2,6-Nonadienal	C9H14O	138.21	green, cucumber, green leaves	0.00002	0.0007	0.0004	0.00005	0.0005	NIF	NIF	NIF	NIF	Aldehyde	[5], [7], [14], [17], [21], [60]	557-48-2
E-2-Hexenal	trans-2-Hexenal	C6H10O	98.14	bitter, astringent, green leaves, green	0	0.046	0.023	0.6	NIF	NIF	NIF	NIF	NIF	Aldehyde	[7], [21], [29]	6728-26-3
E-2-Methyl-2-pentenoic acid	NIF	C6H10O2	114.14	sour, acidic, sweaty and fruity with a jammy, woody nuance	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[43]	16957-70-3
Epicubenol	epi-Cubenol	C15H26O	222.37	NIF	0.0	0.025	0.013	NIF	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[4], [19]	19912-67-5
Epoxycyclohexane	trans-4,5-Epoxy(E)-2-decenal	C10H20O2	172.27	metallic	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Aldehyde	[6], [29], [46]	123932-68-3
Ethenyl ester cyclohexanecarboxylic acid	NIF	C9H16O2	156.22	fruity, cheese, winery	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[43]	3289-28-9
Ethyl 2-methylbutanoate	Ethyl 2-methylbutyrate	C7H14O2	130.19	NIF	0.0003	0.00077	0.0005	0.001	NIF	NIF	NIF	NIF	NIF	Ester	[51]	7452-79-1
Ethyl 2-methylpropanoate	Ethyl isobutyrate	C6H12O2	116.16	apple, sweet, citrus, fruity, pineapple	0.002	0.01	0.007	0.0011	0.0063	0.045	0.00003	NIF	NIF	Ester	[2], [5], [14], [16], [21]	97-62-1
Ethyl 2-methylpropanoate	NIF	C6H12O2	116.16	NIF	0.002	0.01	0.007	0.164	5	NIF	NIF	NIF	NIF	Ester		97-62-1
Ethyl 3-methylbutanoate	Ethyl 3-methylbutyrate, Ethyl isovalerate	C7H14O2	130.19	fruity, apple, sweet, valeric, citrus, wine-like, artificial strawberry, candy, violet	0.0006	0.007	0.004	0.002	0.09	1.3	0.00003	NIF	NIF	Ester	[5], [14], [16], [21], [26], [31]	108-64-5
Ethyl 4,8-decadienoate	NIF	C12H20O2	196.29	NIF	0.008	0.02	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[4], [12], [39]	60388-64-9
Ethyl 4-decenoate	NIF	C12H22O2	198.31	NIF	0.018	0.1	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[4]	6142-44-5
Ethyl 4-methylpentanoate	NIF	C8H16O2	144.21	fruity, citrus, pineapple	0.0001	0.0003	0.0002	0.001	0.018	NIF	NIF	NIF	NIF	Ester	[2], [5], [14]	25415-77-2
Ethyl caproate	NIF	C8H16O2	144.21	fruity, rum	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[40]	123-66-0
Ethyl cinnamate	Ethyl 3-phenyl-2-propenoate	C13H12O2	176.21	fruity, sweet, cinnamon-like, honey-like, strawberry	NIF	NIF	0.005	NIF	NIF	NIF	0.00006	NIF	NIF	Ester	[16], [29], [31], [40]	103-36-6
Ethyl cis-4-decenoate	NIF	C12H22O2	198.31	green, fruity, waxy, leathery	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	7367-84-2
Ethyl ester benzoic acid	NIF	C9H10O2	150.17	fruity, dry, musty, sweet, wintergreen	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[43]	93-89-0
Ethyl ester pentanoic acid	NIF	C7H14O2	130.19	sweet, fruity, apple, pineapple, green, tropical	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[43]	539-82-2
Ethyl nonanoate	NIF	C11H22O2	186.29	fruity, rose, nutty, oily	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	123-29-5
Ethyl nonanoate	NIF	C11H22O2	184.28	NIF	NIF	NIF	0.023	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[4]	17463-01-3
E-α-Bergamotene	a-trans-bergamotene	C15H24	204.35	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[29], [54]	13474-59-4
Farnesene	NIF	C15H24	204.35	woody, green apple, lavender, sweet	0.001	0.005	0.003	0.16	0.55	0.63	NIF	NIF	NIF	Sesquiterpene	[4], [5], [9], [46]	502-61-4
Farnesol	NIF	C15H26O	222.37	lily	NIF	NIF	>30 ppm	NIF	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[4], [12], [46]	4602-84-0
g-Cadinene	NIF	C15H24	204.35	NIF	NIF	NIF	>30 ppm	NIF	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[4]	39029-41-9
g-Caryophyllene	NIF	C15H24	204.35	NIF	NIF	NIF	0.027	0.48	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[4]	118-65-0
Geraniol	a-citral	C10H16O	152.24	citrus, lemon, floral	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Monoterpene	[29], [44], [46]	141-27-5
Geranic acid	cis/trans-Geranic acid	C10H16O2	168.24	woody, flowery	NIF	NIF	0.001	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[42], [46]	459-80-3
Geraniol	NIF	C10H18O	154.25	floral, citrus, rose-like, flowery, lime, lemon, hyacinth, geranium	0.001	0.2	0.1	0.004	0.01	0.036	NIF	NIF	NIF	Monoterpene alcohol	[1], [4], [9], [11], [12], [13], [14], [17], [19], [21], [22], [29], [54]	106-24-1
Geraniol	NIF	C10H18O	154.25	NIF	0.001	0.2	0.1	0.07	0.3	0.5	NIF	NIF	NIF	Monoterpene alcohol		106-24-1
Geranyl acetate	NIF	C12H20O2	196.29	floral (lavender), perfumed pine	NIF	NIF	0.035	NIF	NIF	NIF	NIF	NIF	NIF	Monoterpene	[11], [12], [15], [29], [40]	105-87-3
Geranyl isobutyrate	Geranyl 2-methylpropanoate, Geranyl isobutanoate	C14H24O2	224.34	floral (rose)	0.025	0.15	0.088	0.45	NIF	NIF	NIF	NIF	NIF	Ester	[12], [17], [29]	2345-26-8
Geranyl propanoate	NIF	C13H22O2	210.32	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[29]	105-90-8
Geranyllic acid	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[54]	NIF
Germacrene B	NIF	C15H24O	220.35	mushroom, balsamic	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[60]	15423-57-1

Germacrene D	NIF	C15H24O	220.35	NIF	NIF	NIF	>30 ppm	NIF	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[4]	37839-63-7
g-Eudesmol	NIF	C15H26O	222.37	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[54]	1209-71-8
g-Nonalactone	NIF	C9H16O2	156.22	coconut, vanilla, glue, rancid, peach, fruity, sweet	0.02	0.5	0.3	0.03	NIF	NIF	NIF	NIF	Lactone	[1], [5], [16], [26], [29], [31], [40]	104-61-0	
g-Selinene	NIF	C15H24	204.35	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[44]	515-17-3	
g-Terpinene	NIF	C10H16	136.23	citrus, terpene, spicy	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Monoterpene	[29], [59]	99-85-4	
Heptanoic acid	NIF	C7H14O2	130.19	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[54]	111-14-8	
Heptyl 2-methylbutanoate	NIF	C13H26O2	214.35	apple	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	29811-50-5	
Heptyl 2-methylpropanoate	NIF	C11H22O2	186.29	apricot, cherry, apple, green	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	2349-13-5	
Heptyl butanoate	Heptyl butyrate	C11H22O2	186.29	fruity, herbaceous	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	5870-93-9	
Heptyl ester acetic acid	NIF	C9H18O2	158.24	woody, citrus, pear, apricot	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[43]	112-06-1	
Heptyl propanoate	NIF	C10H20O2	172.27	rose, apricot	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	2216-81-1	
Hexanal	n-Hexanal, 1-Hexanal	C6H12O	100.16	bitter, winey, vinous, green, leafy, aldehyde, grassy	0	0.07	0.035	0.09	0.35	NIF	NIF	NIF	Aldehyde	[1], [5], [7], [14], [17], [21], [26], [44]	66-25-1	
Hexanethiolate	NIF	C6H12OS	132.23	NIF	NIF	NIF	>30 ppm	NIF	NIF	NIF	NIF	NIF	Thioester	[4]	NIF	
Hexanoic acid	Caproic acid	C6H12O2	116.16	goaty, fatty acid, vegetable oil, sweaty, caprylic	0.5	8	4.3	8	10.7	NIF	NIF	NIF	Acid	[1], [3], [17], [20], [21], [54]	142-62-1	
Hexyl 2-methylbutanoate	NIF	C13H22O2	186.29	fresh, green, fruity	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	10032-15-2	
Hexyl 2-methylpropanoate	NIF	C10H20O2	172.27	green, fruity, apple, pear	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[29], [59]	2349-07-7	
Hexyl 3-methylbutanoate	NIF	C11H22O2	186.29	unripe fruit, apple, strawberry	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	10032-13-0	
Hop ether	NIF	C10H16O	152.24	NIF	0.01	0.035	0.023	0.1	NIF	NIF	0.005	NIF	Monoterpene	[4], [12], [15], [19], [54], [56], [58]	19901-95-2	
Hop furanone X	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Other	[58]	NIF	
Hop furanone Z	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Other	[56]	NIF	
Hop oils	NIF	NIF	NIF	NIF	NIF	NIF	NIF	0.0008	0.005	0.5	0.012	NIF	NIF	[39]	NIF	
Humuladienone	NIF	C15H22O	218.33	spicy, grassy, flowery, fresh	0.01	0.7	0.36	0.1	NIF	NIF	NIF	NIF	Terpenoid	[4], [17], [19], [29], [34], [40]	144614-66-4	
Humulene	α-Humulene	C15H24	204.35	balsamic, flowery, grassy, herbal, spicy, woody, clove oil	0.0002	0.063	0.032	0.05	0.45	0.63	0.12	NIF	Sesquiterpene	[4], [5], [9], [13], [29], [44], [46], [59]	6753-98-6	
Humulene diepoxide	NIF	C15H24O2	236.36	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[29]	11066-50-5	
Humulene diepoxide A	NIF	NIF	NIF	NIF	NIF	NIF	0.169	NIF	NIF	NIF	NIF	NIF	Oxygenated Sesquiterpenoids	[29], [42]	NIF	
Humulene diepoxide B	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Oxygenated Sesquiterpenoids	[29]	NIF	
Humulene diepoxide C	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Oxygenated Sesquiterpenoids	[29]	NIF	
Humulene diepoxide D, E	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Oxygenated Sesquiterpenoids	[29]	NIF	
Humulene diepoxide II	NIF	NIF	NIF	NIF	0.017	0.033	0.025	NIF	NIF	NIF	NIF	NIF	Oxygenated sesquiterpene	[15]	NIF	
Humulene diepoxide III	Humulene-1,2,4,5-diepoxide	C15H24O	220.35	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Oxygenated sesquiterpene	[15]	21624-36-2	
Humulene diepoxide V	NIF	NIF	NIF	NIF	0.011	0.03	0.021	NIF	NIF	NIF	NIF	NIF	Oxygenated sesquiterpene	[15]	NIF	
Humulene epoxide I	Humulene oxide I, Humulene-8,9-epoxide	C15H24O	220.35	hay-like, grassy, herbal, spicy, kettle hop aroma	0.0001	0.125	0.06	0.01	0.45	NIF	0.01	NIF	Oxygenated sesquiterpene	[4], [5], [6], [11], [12], [13], [15], [17], [29], [54], [55], [58]	19888-33-6	
Humulene epoxide I, II, III	NIF	NIF	NIF	musty, floral, spicy	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Oxygenated sesquiterpene	[29]	NIF	
Humulene epoxide II	Humulene oxide II, Humulene-1,2-epoxide	C15H24O	220.35	moldy, cedar, lime, herbal	0.002	0.27	0.14	0.45	NIF	NIF	NIF	NIF	Oxygenated sesquiterpene	[4], [5], [6], [11], [17], [29], [43], [54]	19888-34-7	
Humulene epoxide III	Humulene oxide III, Humulene-4,5-epoxide	C15H24O	220.35	cedar	NIF	NIF	0.02	NIF	NIF	NIF	NIF	NIF	Oxygenated sesquiterpene	[6], [12], [19], [29], [58]	NIF	
Humulenol	Humulenol I	C15H24O	220.35	sagebrush-like, pineapple	0.001	1.15	0.58	0.15	0.5	2.5	NIF	NIF	Sesquiterpene	[4], [5], [6], [11], [12], [13], [17]	19888-01-8	
Humulenol II	NIF	C15H24O	220.35	NIF	NIF	NIF	NIF	2.5	NIF	NIF	NIF	NIF	Sesquiterpene		19888-00-7	
Humulenol II	b-Humulene-1-ol	C15H24O	220.35	sagebrush, pineapple, herbal, spicy, noble, hoppy, kettle hop aroma	0.013	1.05	0.532	0.15	0.5	1.05	NIF	NIF	Sesquiterpene	[12], [15], [19], [29], [55], [57], [58]	19888-00-7	
Humulene	NIF	C15H22O	218.33	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Terpenoid	[4], [29], [54]	19888-05-2	
Humulol	NIF	C15H26O	222.37	hay-like, kettle hop aroma	0.05	0.22	0.135	1.05	2.0	NIF	NIF	NIF	Sesquiterpene	[4], [19], [29], [54], [55], [57], [58]	24405-58-1	
Hydrogen sulfide	NIF	H2S	34.08	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Sulfide	[34]	7783-06-4	
Isoamyl 4-decanoate	NIF	NIF	NIF	NIF	0.01	0.02	0.015	NIF	NIF	NIF	NIF	NIF	Ester	[4]	NIF	
Isoprene	2-Methyl-1,3-butadiene	C5H8	68.12	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Hydrocarbon	[4]	78-79-5	
Isovaleric acid	3-Methylbutanoic acid, 3-Methylbutyric acid	CSH10O2	102.13	sweat, cheese, rancid, old hops, floral, minty, sweet, smelly socks	0.1	3.5	1.8	0.325	0.4	0.85	NIF	NIF	Acid	[1], [2], [3], [4], [9], [14], [17], [20], [21], [22], [23], [27], [28], [31], [40], [44], [54], [60]	503-74-2	
Isovaleric acid	NIF	CSH10O2	102.13	NIF	0.1	3.5	1.8	1.5	NIF	NIF	NIF	NIF	Acid		503-74-2	
Junenol	NIF	C15H26O	222.37	NIF	0.005	0.01	0.008	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[4], [39]	472-07-1	
Juniper camphor	NIF	C15H26O	222.37	NIF	NIF	NIF	>30 ppm	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[4], [39]	473-04-1	
Karahana ether	Karahana	C10H16O	152.24	NIF	0.04	0.08	0.06	0.10	NIF	NIF	0.005	NIF	Terpene	[4], [12], [19], [39], [54], [56], [58]	19901-96-3	
Karahanaenone	2,2,5-Trimethylcyclohept-4-enone	C10H16O	152.24	NIF	0.003	0.06	0.03	NIF	NIF	NIF	NIF	NIF	Ketone	[4]	19822-67-4	
Ledene oxide	NIF	C15H24O	220.35	minty	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Oxide	[44]	NIF	
Limonene	NIF	C10H16	136.23	citrus, orange, green, fruity	0.75	0.10	0.43	0.1	1.493	NIF	NIF	NIF	Monoterpene	[4], [5], [19], [29], [46], [59]	138-86-3	
Limonene dioxide	NIF	C10H16O2	168.24	citrus	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Oxide	[44]	96-08-2	
Limonene-10-ol	NIF	C10H16O	152.24	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Monoterpene alcohol	[29]	3269-90-7	

Linalool	R/5-Linalool	C10H18O	154.25	florery, fruity, floral, citrus, rosewood-like, aniseed, terpenic, rose-like, hoppy, coriander seed	0.001	0.5	0.2	0.001	0.008	0.009	0.00014-0.006	*can be formed by geraniol decomposition by yeast *amount affected by time and amount of hops added during boil *correlation between linalool concentration and flowery-fruity hop aroma *biosynthetic product from myrcene *ratio for most hops is ~93% R-Linalool and ~7% L-Linalool	Monoterpene alcohol	[1], [2], [3], [4], [5], [9], [11], [13], [14], [16], [17], [21], [28], [29], [40], [55]	78-70-6	
Linalool	NIF	C10H18O	154.25	NIF	0.001	0.5	0.2	0.027	0.08	NIF	NIF	NIF	NIF	Monoterpene alcohol		78-70-6
Linalool	NIF	C10H18O	154.25	NIF	0.001	0.5	0.2	0.1	NIF	NIF	NIF	NIF	NIF	Monoterpene alcohol		78-70-6
Linalool oxide I	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Oxide	[56]	NIF
Linalool oxide II	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Oxide	[56]	NIF
Linalool oxides	NIF	NIF	NIF	citrus, green, woody	0	0.05	0.025	200	NIF	NIF	NIF	NIF	NIF	Oxide	[11], [12], [39], [46]	NIF
Linalyl acetate	NIF	C12H20O2	196.29	NIF	NIF	NIF	trace	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[4], [29]	115-95-7
m-Camphorene	NIF	C10H16	136.24	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Terpene	[32]	NIF
Methanethiol	NIF	CH4S	48.11	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Sulfur compound	[34]	74-93-1
Methional	NIF	C4H8OS	104.17	NIF	0.001	1	0.5	0.25	NIF	NIF	NIF	NIF	NIF	Aldehyde		3268-49-3
Methional	3-Methylthiopropenal, 4-Thiagentalan, 3-(Methylsulfanyl)-propanal	C4H8OS	104.17	cooked/boiled potatoes, soup-like, warm, raw potato, mashed potato	0.001	1	0.5	0.004	0.008	0.04	0.00004	*found in hop oil *mainly originates from the oxidative degradation of methionine in the presence of light and riboflavin *also created by the Strecker degradation of methionine *component in aged beer *inappropriate storage of the finished beer	Sulfide	[1], [5], [7], [11], [16], [17], [21], [26], [32], [60]	3268-49-3	
Methyl 10-undecenoate	NIF	C12H22O2	198.31	banana, honey, rose, earthy	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	111-81-9
Methyl 2,6-dimethylheptanoate	NIF	C10H20O2	172.27	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	33315-72-9
Methyl 2-methylbutanoate	NIF	C6H12O2	116.16	sweet, fruity, apple-like	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[29]	868-57-5
Methyl 2-methylheptanoate	NIF	C9H18O2	158.24	pineapple	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	51209-78-0
Methyl 2-methylpropanoate	NIF	C5H10O2	102.13	pineapple	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	547-63-7
Methyl 3,6-dodecadienoate	NIF	C13H22O2	210.32	floral	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	16106-01-7
Methyl 3-nonenoate	NIF	C10H18O2	170.25	fruity, green, pear-like, melon	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	13481-87-3
Methyl 4,6-dimethyloctanoate	NIF	C11H22O2	186.29	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	NIF
Methyl 4,8-dodecadienoate	NIF	C11H20O2	182.26	NIF	0.0001	0.01	0.005	0.2	0.3	NIF	NIF	*appears as Ethyl 4,8-decadienoate in beer	NIF	Ester	[4], [12], [54]	1191-03-3
Methyl 4-decenoate	NIF	NIF	NIF	NIF	0.0001	0.012	0.006	0.2	0.3	NIF	NIF	NIF	NIF	Ester	[4], [54]	NIF
Methyl 4-methyl-2-hexenoate	Methyl 4-methyl-hex-2-enoate	C8H14O2	142.20	NIF	0.013	0.03	0.022	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[4], [15], [54]	54378-97-1
Methyl 4-methyloctanoate	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	NIF
Methyl 6-methylheptanoate	NIF	C9H18O2	158.24	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[29], [54], [59]	2519-37-1
Methyl 7-methylnonanoate	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[54]	NIF
Methyl 8-methylnonanoate	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[54]	NIF
Methyl cis-4-decenoate	Methyl 2-4-decenoate	C11H20O2	184.28	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[29], [59]	7367-83-1
Methyl decanoate	Methyl caprate	C11H22O2	186.29	coconut, fatty acids, fruity, oily	NIF	NIF	trace	1	NIF	NIF	NIF	NIF	NIF	Ester	[4], [21], [54], [59]	110-42-9
Methyl dithioacetate	NIF	C3H6S2	106.21	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Sulfur compound	[34]	2168-84-5
Methyl dodecadienoate	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[54]	NIF
Methyl dodecenoate	Methyl laurate	C13H26O2	214.35	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[54]	111-82-0
Methyl E-2-decenoate	NIF	C11H20O2	184.28	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[29]	7367-85-3
Methyl geranate	Methyl (E)-geranate	C11H18O2	182.26	waxy, green, fruity, floral	NIF	NIF	0.022	NIF	NIF	NIF	NIF	NIF	*Ester from a conjugated acid resist hydrolysis and can be found in beer *ester of terpene alcohol	Monoterpene	[4], [12], [15], [29], [43], [54], [59]	1189-09-9
Methyl heptanoate	NIF	C8H16O2	144.21	fruity	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[54], [59]	106-73-0
Methyl hexanoate	NIF	C7H14O2	130.19	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[54]	106-70-7
Methyl hexenoate	NIF	C7H12O2	128.17	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[4]	13894-63-8
Methyl nerolate	NIF	C11H18O2	182.26	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[29]	1862-61-9
Methyl nonanoate	NIF	C10H20O2	172.27	citrus	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[54], [59]	1731-84-6
Methyl nonenoate	NIF	C10H18O2	170.25	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[54]	3782-76-7
Methyl octanoate	NIF	C8H16O2	158.24	waxy, orange, fruity, green	NIF	NIF	8	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[4], [54], [59]	111-11-5
Methyl trans-3-decenoate	NIF	C11H20O2	184.28	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	NIF
Methyl trans-4-decenoate	NIF	C11H20O2	184.28	fruity	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	93979-14-7
Methyl undecenoate	NIF	C12H22O2	198.31	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[54]	25339-67-7
Methyl-2-methylpropanethiolate	S-Methyl-2-methylthiopropionate	C5H10O2S	134.20	chessy, estery, cooked vegetable	NIF	NIF	NIF	0.005	NIF	NIF	NIF	NIF	*derived from hop oil *almost all removed through fermentation	Thioester	[10], [18]	42075-45-6
Methylbutyl hexanoate	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[59]	NIF
Myrcene	β-Myrcene, 7-Methyl-3-methylene-1,6-octadiene	C10H16	136.23	herbs, metallic, resinous, spicy, balsamic, geranium-like, green, peppery, terpene, balsam, plastic, sweet carrot, slight piney, celery, lemon, woody	0.0001	1	0.5	0.009	0.01	0.03	0.013-0.042	*biosynthetic product during hop growth, and therefore degrades to geraniol and linalool	Monoterpene	[4], [5], [9], [13], [17], [29], [43], [44], [59]	123-35-3	
Myrcene	NIF	C10H16	136.23	NIF	0.0001	1	0.5	0.2	0.5	1.0	NIF	NIF	NIF	Monoterpene		123-35-3
Myrcene disulfide	4-(4-methylpent-3-enyl)-3,6-dihydro-1,2-dithiane	C10H16S2	200.36	fragrant, grassy	NIF	NIF	NIF	0.01	NIF	NIF	NIF	NIF	*created by the reaction of sulfur and myrcene *could be present in late-hopped beers or by steam distillation of hops	Sulphur-containing terpenoid	[10], [18], [32], [34]	73188-23-5
Myrcenol	NIF	C10H18O	154.25	NIF	NIF	NIF	0.01	NIF	NIF	NIF	NIF	NIF	NIF	Terpenoid	[4]	543-39-5
Myrtenol	NIF	C10H16O	152.24	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Monoterpene alcohol	[29]	515-00-4
N-(methyl)mercaptoacetamide	NIF	C3H7NOS	105.16	sweat, fruity	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Other	[40]	20938-74-3
Neral	Z-Citral	C10H16O	152.24	citrus, spicy, lemon, green	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	*isomer of citral *rapidly reduced to their alcohol during storage or fermentation *oxidation product of nerol	Monoterpene	[29], [46]	106-26-3
Nerol	NIF	C10H18O	154.25	flowery (hyacinth, rose), lime, lemon, fresh	NIF	NIF	NIF	0.08	0.5	NIF	NIF	NIF	*usually at a low concentration in beer *no direct contribution to the hop aroma	Monoterpene alcohol	[5], [9], [21], [43]	106-25-2
Nerolidol	NIF	C15H26O	222.37	NIF	0.02	0.075	0.048	NIF	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[4], [12], [29], [54], [55]	7212-44-4
Neryl acetate	NIF	C12H20O2	196.29	NIF	0	0.01	0.005	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[41]	141-12-8
Neryl isobutanoate	NIF	C14H24O2	224.34	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[29]	2345-24-6
Neryl propanoate	NIF	C13H22O2	210.32	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[29]	105-91-9
Nonanal	n-Nonanal	C9H18O	142.24	bitter, astringent, cardboard, aldehydic, citrus, soapy, fatty, green, fruity, floral, wax	0	0.014	0.007	0.018	NIF	NIF	NIF	NIF	*in hop oil but mainly lost during kiln of hops	Aldehyde	[7], [17], [21], [29], [59], [60]	124-19-6
Nonanoic acid	NIF	C9H18O2	158.24	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[54]	112-05-0
Nonenoic acid	NIF	C9H16O2	156.22	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[54]	29830-11-3
Ocimene	NIF	C10H16	136.23	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Monoterpene	[4], [29], [39]	13877-91-3
Octanal	NIF	C8H16O	128.21	citrus	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Aldehyde	[60]	124-13-0
Octanoic acid	Caprylic acid	C8H16O2	144.21	rancid	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[44], [54]	124-07-2
Octenyl acetate	NIF	C10H18O2	170.25	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ester	[29]	32717-31-0

Undecanal	NIF	C11H20O	170.29	fruity, green, wax	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ketone	[59]	112-44-7
Undecen-2-one	NIF	C11H20O	170.29	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Ketone	[54]	27936-14-7
Undecenol acid	NIF	C11H20O2	184.28	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[54]	1333-28-4
Valencene	NIF	C15H24	204.35	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	*located in the non-polar fraction from oxidized hops	Sesquiterpene	[44]	4630-07-3
Vanillin	NIF	C8H8O3	152.15	vanilla	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	*located in the polar fraction of hops	Aldehyde	[44], [60]	121-33-5
Viridiflorene	Ledene	C15H24	204.35	NIF	NIF	NIF	>30 ppm	NIF	NIF	NIF	NIF	NIF	*located in the non-polar fraction from oxidized hops	Sesquiterpene	[4]	21747-46-6
Ylangene	a-Ylangene	C15H24	204.35	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	*derived from hop oil *located in the non-polar fraction from oxidized hops	Sesquiterpene	[12], [29]	14912-44-8
Z-1,5-Octadien-3-one	cis-1,5-Octadien-3-one, Octadienone, (5Z)-Octa-1,5-dien-3-one	C8H12O	124.18	green, metallic, geranium-like (leaf)	NIF	NIF	NIF	0.000034	NIF	NIF	NIF	NIF	NIF	Ketone	[6], [14], [60]	50306-18-8
Z-3-Hexen-1-ol	NIF	C6H12O	100.16	green	0.0015	0.013	NIF	0.884	NIF	NIF	NIF	NIF	NIF	Alcohol	[51]	928-96-1
Z-3-Hexenal	cis-3-Hexenal	C6H10O	98.14	green, leafy, green leaves, freshly cut grass	NIF	NIF	NIF	0.02	NIF	NIF	NIF	NIF	*created by the degradation (enzymatic, auto- or photooxidative) of the fatty acid linolenic acid during ageing *present in freshly picked hops *lost during the kilning of hops	Aldehyde	[1], [5], [6], [14], [21]	6789-80-6
Z-3-Hexenoic acid	NIF	C6H10O2	114.14	rancid, sweaty	NIF	NIF	NIF	1.3	NIF	NIF	NIF	NIF	NIF	Acid	[51]	1775-43-5
Z-4-Decanoic acid	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[29]	NIF
Z-a-Bergamotene	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Sesquiterpene	[29]	NIF

Chemical Name	Synonyms	Structure	Molecular Weight (g/mol)	Flavor Descriptors	Bitterness compared to Isohumulone at 100% (%)	Conc. Minimum (mg/l)	Conc. Maximum (mg/l)	Conc. Mean (mg/l)	TH 1 (mg/l)	TH 2 (mg/l)	TH Water (mg/l)	Formation/Description	Compound Classification	References	CAS Number
(-)-Epicatechin	NIF	C15H14O6	290.26	NIF	NIF	0.01	1.1	0.56	NIF	NIF	NIF	NIF	Phenol	[6], [33], [49]	490-46-0
(+)-Catechin	NIF	C15H14O6	290.26	NIF	NIF	0	12.6	6.31	NIF	NIF	NIF	NIF	Phenol	[6], [33], [49]	154-23-4
2-Perhydroxylupulone	NIF	NIF	NIF	pleasantly strong bitter	NIF	NIF	NIF	NIF	NIF	NIF	NIF	*can be synthetically produced b-acid derivative	Acid	[39]	NIF
4-Acetylhumulinic acid	Weicharz B	C17H24O5	308.37	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[4]	NIF
4-Desoxyhumulone	NIF	C21H30O4	346.46	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[39]	NIF
4-Desoxycohulomulone	NIF	C20H28O4	332.43	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[39], [53]	NIF
4-Desoxyhumulone	NIF	C21H30O4	346.46	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	*precursor of humulone and lupulone *suspected to cause bittering with 1st homologues 4-Desoxyadhumulone and 4-Desoxycohulomulone	Acid	[39]	NIF
6-Prenylnaringenin	6-PN	C20H20O5	340.37	NIF	NIF	0.001	0.56	0.28	NIF	NIF	NIF	*found in hops	Phenol	[6], [49]	68236-13-5
8-Prenylnaringenin	8-PN	C20H20O5	340.37	NIF	NIF	0.001	0.24	0.12	NIF	NIF	NIF	*found in hops	Phenol	[6], [49]	53846-50-7
a-Acids	NIF	NIF	NIF	NIF	NIF	NIF	4.000	NIF	NIF	NIF	NIF	*no bitter taste up to 100mg/l *improve foam stability *suppress gushing *contribute to bacteriological stability *sum of all a-acids	Acid	[61]	NIF
Abeo-isohumulones	Abeo-iso-a-acids	C21H28O6	376.44	not bitter/tasteless	10-20	6.0	175.0	91	100.00	NIF	NIF	*low bitterness *positive for head retention *series of seven oxidation products derived from isohumulones *0.5-1.15% in hops	Acid	[4], [39], [53], [61]	NIF
Adhulopone	NIF	C21H30O4	346.46	NIF	NIF	0.35	0.43	0.4	NIF	NIF	NIF	NIF	Acid	[47]	NIF
Adhumulone	NIF	C21H30O5	362.46	NIF	NIF	0.61	0.93	0.8	NIF	NIF	NIF	*oxidation product of adhumulone *10-15% content of the hop alpha acids, relatively stable between hop varieties	Acid	[47], [61]	NIF
Adhumulone	NIF	C21H30O5	362.46	NIF	NIF	0.06	0.35	0.2	NIF	NIF	NIF	NIF	Acid	[47], [61]	31769-65-0
Adlupulone	NIF	C26H38O4	414.58	NIF	NIF	0.11	0.15	0.1	NIF	NIF	NIF	*10-15% content of b-acids	Acid	[47]	31769-60-5
Allo-isohumulone A	NIF	C21H30O5	362.46	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[53]	NIF
Allo-isohumulone B	NIF	C21H30O5	362.46	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[53]	NIF
Allo-isohumulones	Allo-iso-a-acids	C21H30O5	394.46	bitter	120-150	0.1	5.0	2.6	2.75	NIF	NIF	NIF	Acid	[4], [5], [39]	NIF
Allo-isohumulonehydroperoxide	NIF	NIF	NIF	NIF	NIF	NIF	NIF	0.1	NIF	NIF	NIF	NIF	Other	[5]	NIF
Allo-isohumulonehydroxide	NIF	NIF	NIF	NIF	NIF	NIF	NIF	0.1	NIF	NIF	NIF	NIF	Other	[5]	NIF
Anti-isohumulones	NIF	C21H30O5	362.46	bitter	200	NIF	NIF	trace	NIF	NIF	NIF	*bitterest of all hop acids *only in trace amounts in beer	Acid	[4], [39], [61]	NIF
Ashurst's compound	NIF	NIF	NIF	astringent	20	0.4	3.0	1.7	NIF	NIF	NIF	NIF	Acid	[4], [48]	NIF
cis-Adhumulinic acid	NIF	C15H21O4	265.32	NIF	NIF	0.007	0.010	0.008	NIF	NIF	NIF	NIF	Other	[47]	NIF
cis-Alloisohumulonehydroperoxide	NIF	NIF	NIF	NIF	NIF	0.008	0.020	0.014	NIF	NIF	NIF	NIF	Other	[47]	NIF
cis-Alloisohumulonehydroxide	NIF	NIF	NIF	NIF	NIF	0.017	0.028	0.023	NIF	NIF	NIF	NIF	Other	[47]	NIF
cis-Alloisohumulonehydroxide	NIF	NIF	NIF	NIF	NIF	0.023	0.033	0.028	NIF	NIF	NIF	NIF	Other	[47]	NIF
cis-Alloisohumulonehydroperoxide	NIF	NIF	NIF	NIF	NIF	0.023	0.047	0.035	NIF	NIF	NIF	NIF	Other	[47]	NIF
cis-Alloisohumulonehydroxide	NIF	NIF	NIF	NIF	NIF	0.039	0.052	0.046	NIF	NIF	NIF	NIF	Other	[47]	NIF
cis-Antiisohumulones	cis-antiso-a-acids	C21H30O5	362.46	bitter	NIF	0.8	4.0	2.4	NIF	NIF	NIF	5 types	Acid	[4]	NIF
cis-Cohumulonic acid	NIF	C14H20O4	252.31	NIF	NIF	0.009	0.016	0.013	NIF	NIF	NIF	NIF	Acid	[47]	NIF
cis-Humulonic acid	NIF	C15H22O4	266.33	NIF	NIF	0.019	0.025	0.022	NIF	NIF	NIF	NIF	Acid	[47]	NIF
cis-iso-a-acids	NIF	NIF	NIF	bitter	NIF	5.0	23.0	14.0	4.0	NIF	NIF	5 types	Acid	[4]	NIF
cis-isoadhumulone	NIF	C21H30O5	362.46	NIF	NIF	3.66	4.35	4.0	NIF	NIF	NIF	NIF	Acid	[47]	NIF
cis-Isocohumulone	NIF	C20H28O5	348.43	NIF	NIF	7.81	8.55	8.2	NIF	NIF	NIF	NIF	Acid	[47]	NIF
cis-Isosohumulone	NIF	C21H30O5	362.46	NIF	NIF	4.4	10.28	7.3	NIF	NIF	NIF	NIF	Acid	[47], [53]	1534-03-8
Cohulopone	NIF	C19H20O4	312.36	NIF	NIF	1.07	1.50	1.3	NIF	NIF	NIF	NIF	Acid	[47]	1891-34-5
Cohumulone	NIF	C20H28O5	348.43	NIF	NIF	0.91	1.23	1.1	NIF	NIF	NIF	*oxidation product of cohulomulone	Acid	[47], [61]	NIF
Cohulomulone	NIF	C20H28O5	348.43	NIF	NIF	0.75	2.55	1.7	NIF	NIF	NIF	*20-65% content of the hop alpha acids, depending on hop variety	Acid	[47], [61]	511-25-1
Colupox a	NIF	C25H36O5	416.55	NIF	NIF	NIF	NIF	trace	NIF	NIF	NIF	*formed by the oxidation of colupulone	Acid	[61]	NIF
Colupox b	NIF	C25H36O5	416.55	NIF	NIF	NIF	NIF	trace	NIF	NIF	NIF	NIF	Acid	[61]	NIF
Colupox c	NIF	C25H36O5	416.55	NIF	NIF	NIF	NIF	trace	NIF	NIF	NIF	*formed by the oxidation of colupulone	Acid	[61]	NIF
Colupulone	NIF	C25H36O4	400.55	tasteless	NIF	0.11	0.30	0.2	NIF	NIF	NIF	*20-55% content of b-acids	Acid	[47], [61]	468-27-9
Connet's compound	NIF	NIF	NIF	bitter, astringent	0.2	1.5	0.85	NIF	NIF	NIF	NIF	NIF	Acid	[4], [48]	NIF
Deacetylated acetylhumulinic acid	NIF	C12H16O4	224.25	NIF	NIF	NIF	NIF	trace	NIF	NIF	NIF	4 types	Acid	[4]	NIF
Deacetylated anti-humulone	NIF	NIF	NIF	slightly bitter	50	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[39]	NIF
Deacetylated humulinic acid	NIF	NIF	NIF	NIF	NIF	NIF	NIF	trace	NIF	NIF	NIF	2 types	Acid	[4]	NIF
Deacetylated iso-a-acids	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[4]	NIF
Dehydrated hydroxyalloisohumulones (spiro)	Spiro-isohumulone	C21H30O5	362.46	bitter	low	NIF	NIF	trace	NIF	NIF	NIF	NIF	Acid	[4], [39]	31319-12-7
Dehydroisohumulonic acid	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	*oxidation product of humulone	Acid	[39]	NIF
Desmethylxanthohumol	NIF	C20H20O5	340.37	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	*found in hops	Phenol	[6]	115063-39-3
Dihydrohumulone	NIF	C21H32O5	364.47	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	Acid	[39]	NIF
Dihydroisohumulone	Dihydro-iso-a-acid	C21H32O5	364.47	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	*improves foam stability similar to iso-a-acids	Acid	[50]	24149-26-6
Dihydrooxyhumulinic acid	NIF	C15H23O5	283.34	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	*oxidation product of humulone	Acid	[39]	NIF
Ferulic acid	NIF	C10H10O4	194.18	NIF	NIF	1.420	1.980	1.70	NIF	NIF	NIF	NIF	Acid	[49]	1135-24-6
Hexahydrocolupulone	NIF	C25H42O4	406.60	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	*can be synthetically produced b-acid derivative	Acid	[39]	52755-22-3
Hexahydrohumulone	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	*could cause gushing	Acid	[39]	NIF
Hexahydroisohumulones	NIF	NIF	NIF	bitter	100-120	5.0	20.0	12.5	NIF	NIF	NIF	NIF	Acid	[4]	NIF
Hexahydrodulpulone	NIF	C20H36O3	324.50	NIF	NIF	NIF	NIF	NIF	NIF	NIF	NIF	*synthetically produced b-acid derivative	Acid	[39]	NIF
Homovanillic acid	3-Methoxy-4-hydroxyphenylacetic acid	C9H10O4	182.17	NIF	NIF	0.02	0.7	0.36	NIF	NIF	NIF	NIF	Phenol	[6], [24]	306-08-1
Hulupinic acid	NIF	C15H20O4	264.32	NIF	NIF	0.023	0.1	0.06	NIF	NIF	NIF	*found in all hops	Acid	[4], [5], [39], [47]	1891-42-5
Hulupone	d-acids	C20H28O4	332.43	NIF	NIF	1	6.0	4	8	10	NIF	*contributes to bitterness *roughly half as bitter as isohumulones *created by the auto-oxidation (contact with oxygen) of the b-acids *formed during wort boiling	Acid	[4], [28], [34], [39], [47], [53], [61]	468-62-2
Humulinic acid	NIF	C15H22O4	266.33	not bitter, slight harsh bitterness	NIF	0.0	3.0	1.5	15	NIF	NIF	*can cause gushing *created by hydrolysis of humulones *one-third as bitter as isohumulones *causes disturbances for spectrophotometric measurement of bitterness	Acid	[4], [39], [53], [61]	520-40-1
Humulonone	NIF	C21H30O5	362.46	bitter, astringent	30	0.3	2.2	1.25	NIF	NIF	NIF	*one-third as bitter as iso-a-acids (not established in beer) *cis-Humulone created from humulonone during wort boiling *oxidation product of humulone	Ketone	[4], [39], [47], [53], [61]	981-03-3
Humulone	a-acids	C21H30O5	362.46	bitter	40-50	0.0	4.0	2.0	8	10	NIF	*helps prevent gushing *35-70% content of the hop alpha acids, depending on hop variety	Acid	[4], [39], [47], [61]	26472-41-3
Hupulonic acid	NIF	NIF	NIF	not bitter	NIF	NIF	NIF	trace	NIF	NIF	NIF	*found in old hop samples *created by hydrolysis of hulupones	Acid	[4], [39], [53]	NIF
Hydrated isohumulone	NIF	NIF	NIF	NIF	NIF	0.0	2.0	1.0	NIF	NIF	NIF	NIF	Acid	[4], [39]	NIF
Hydroxyalloisohumulones	NIF	NIF	NIF	bitter	NIF	NIF	NIF	trace	NIF	NIF	NIF	NIF	Acid	[4]	NIF
Hydroxyepoxy alloisohumulones	NIF	NIF	NIF	bitter	NIF	NIF	NIF	trace	NIF	NIF	NIF	NIF	Acid	[4]	NIF

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Chemical Name	Synonyms	Structure	Molecular Weight (g/mol)	Flavor Descriptors	Conc. Minimum (mg/l)	Conc. Maximum (mg/l)	Conc. Mean (mg/l)	TH 1 (mg/l)	TH 2 (mg/l)	TH 3 (mg/l)	TH Water (mg/l)	Formation/Description	Compound Classification	References	CAS Number
Myrcene	β -Myrcene, 7-Methyl-3-methylene-1,6-octadiene	C10H16	136.23	herbs, metallic, resinous, spicy, balsamic, geranium-like, green, peppery, terpene, balsam, plastic, sweet carrot, slight piney, celery, lemon, woody	0.0001	1	0.5	0.009	0.01	0.03	0,013-0,042	*biosynthetic product during hop growth, and therefore degrades to geraniol and linalool	Monoterpene alcohol	[4], [5], [9], [13], [17], [29], [43], [44], [59]	123-35-3
Myrcene	NIF	C10H16	136.23	NIF	0.0001	1	0.5	0.2	0.5	1.0	NIF	NIF	Monoterpene alcohol		123-35-3