



CHEMICAL COMPOSITION OF CULTIVATED GRAFTING KYNAM

Scientific & Technical Explanation



Sample: Incense powder of Cultivated Grafting Kynam

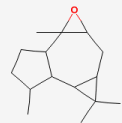
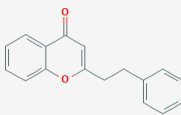
Sample code: CGKi

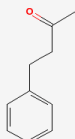
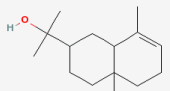
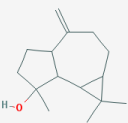
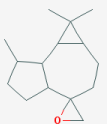
Plant source: Kynam mother Tree

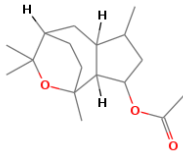
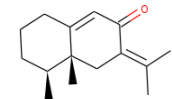
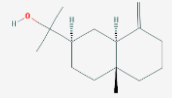
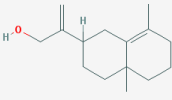
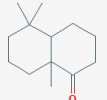
Data of the Test Report is extracted from <https://doi.org/10.1016/j.fitote.2020.104493>

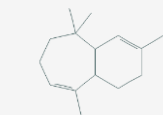
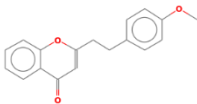
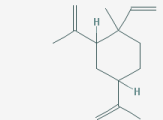
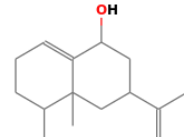
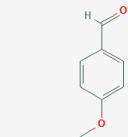
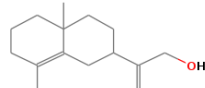
Technical interpretation: Prof. Dinh xuan Ba – SECOIN ABC

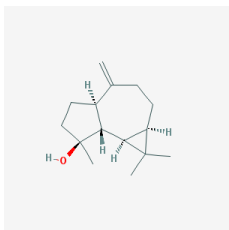
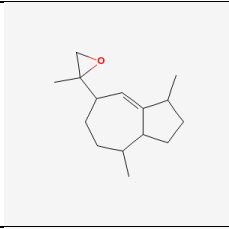
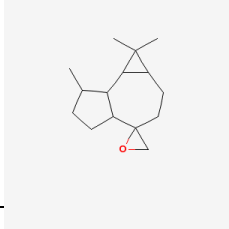
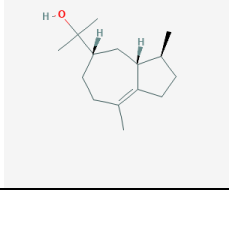
Date: 12 July 2020

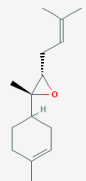
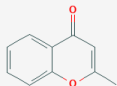
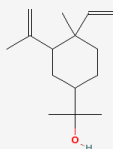
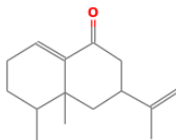
No.	IUPAC* name & preferred common names	Content (%)	CAS#	Molecular Formula/ Weight (g/mol)	Structural Formular	Classification
1	Isoaromadendrene epoxide; 1,3b,6,6-Tetramethyldecahydro-1H-cyclopropa[7,8]azuleno[4,5-b]oxirene; 2,7,7,10-tetramethyl-3-oxatetracyclo[7.3.0.0^{2,4}.0^{6,8}]dodecane;	15.99	85760-81-2	C ₁₅ H ₂₄ O/ 220.35		Sesquiterpenoid
2	2-(2-Phenylethyl)chromone; Flindersiachromone; flidersiachromone; 2-PHENETHYLCHROMONE; 2-Phenethyl-4H-chromen-4-one; 4H-1-Benzopyran-4-one, 2-(2-phenylethyl)-; 2-(2-phenylethyl)-4H-1-benzopyran-4-one; 2-(2-phenylethyl)chromen-4-one;	9.34	61828-53-3	C ₁₇ H ₁₄ O ₂ / 250.29		Chromone

3	Benzaldehyde ; Benzenecarbaldehyde; Benzenecarboxaldehyde; Phenylmethanal; Benzoic aldehyde;	7.11	100-52-7	C ₇ H ₆ O/ 106.12		Oxygenated Monoterpene derivative
4	2-Butanone, 4-phenyl-; 4-Phenyl-2-butanone; BENZYLACETONE; 4-Phenylbutan-2-one ; Phenethyl methyl ketone; 4-phenylbutanone; Methyl phenylethyl ketone;	4.97	2550-26-7	C ₁₀ H ₁₂ O/ 148.2		Oxygenated monoterpene
5	alpha-Eudesmol; 2-(4a,8-dimethyl-2,3,4,5,6,8a-hexahydro-1H-naphthalen-2-yl)propan-2-ol ;	3.69	473-16-5; 92480-60-9	C ₁₅ H ₂₆ O/ 222.366		Sesquiterpene alcohol
6	(-)-Spathulenol; Ent-Spathulenol; (-)-ent-Spathulenol; 1H-Cycloprop[e]azulen-7-ol, decahydro-1,1,7-trimethyl- 4-methylene-; 1,1,7-trimethyl-4-methylidene-1a,2,3,4a,5,6,7a,7b-octahydrocyclopropa[h]azulen-7-ol ;	2.56	77171-55-2	C ₁₅ H ₂₄ O/ 220.35046		Sesquiterpenoid
7	Aromadendrene oxide; Alloaromadendrene oxide; Aromadendrene oxide-(1); Aromadendrene oxide-(2); 1,1,7-trimethylspiro[2,3,4a,5,6,7,7a,7b-octahydro-1aH-cyclopropa[e]azulene-4,2'-oxirane] ; Decahydro-1,1,7-trimethylspiro(4H-cycloprop(e)azulene-4,2'-oxirane);	2.32	94020-95-8	C ₁₅ H ₂₄ O/ 220.35046		Sesquiterpenoid

8	alpha-kessyl acetate; (1S,3R,6R,8R)-1,5,9,9-tetramethyl-10-oxatricyclo[6.2.2.0 ^{2,6}]dodec-3-yl acetate; [(1S,2S,3R,5R,6R,8R)-1,5,9,9-tetramethyl-10-oxatricyclo[6.2.2.0^{2,6}]dodecan-3-yl] acetate;	2.13	17806-59-6 3925-77-7	C ₁₇ H ₂₈ O ₃ / 280.40776		Chromone derivative
9	2(3H)-Naphthalenone, 4,4a,5,6,7,8-hexahydro-4a,5-dimethyl-3-(1-methylethylidene)-, (4ar-cis)-; (4aR,5S)-4a,5-Dimethyl-3-(propan-2-ylidene)-4,4a,5,6,7,8-hexahydronaphthalen-2(3H)-one;	2.07	19598-45-9	C ₁₅ H ₂₂ O/ 218.33		Oxygenated Sesquiterpene derivative
10	Eudesm-4(14)-en-11-ol; beta-Eudesmol; gamma-Eudesmol; beta-Selinenol; 2-[(2R,4aR,8aS)-4a-methyl-8-methylidene-1,2,3,4,5,6,7,8a-octahydronaphthalen-2-yl]propan-2-ol;	2.05	473-15-4	C ₁₅ H ₂₆ O/ 222.36634		Sesquiterpene alcohol
11	2-(4a,8-Dimethyl-1,2,3,4,4a,5,6,7-octahydro-naphthalen-2-yl)-prop-2-en-1-ol; 2-(4a,8-dimethyl-2,3,4,5,6,7-hexahydro-1H-naphthalen-2-yl)prop-2-en-1-ol;	1.96	N/A	C ₁₅ H ₂₄ O/ 220.35046		Sesquiterpenoid
12	5,5,8a-Trimethyldecalin-1-one; 5,5,8a-Trimethyloctahydro-1(2H)-naphthalenone #; 5,5,8a-trimethyl-3,4,4a,6,7,8-hexahydro-2H-naphthalen-1-one;	1.86	N/A	C ₁₃ H ₂₂ O/ 194.31		Chromone derivative

13	gamma-himachalene; 2,5,9,9-tetramethyl-3,4,4a,7,8,9a-hexahydrobenzocycloheptene; 2,5,9,9-tetramethyl-3,4,4a,7,8,9a-hexahydrobenzo[7]annulene ; himachal-4,10-diene; 2,7-Himachaladiene;	1.76	N/A	$C_{15}H_{24}$ 204.35106		Sesquiterpene
14	2-(4-Methoxyphenethyl)-4H-chromen-4-one; 4H-1-Benzopyran-4-one, 2-[2-(4-methoxyphenyl)ethyl]-; 2-[2-(4-Methoxyphenyl)ethyl]chromone; Chromone, 2-[2-(4-methoxyphenyl)ethyl];	1.67	92911-82-5	$C_{18}H_{16}O_3$ / 280.3178		Chromone
15	Beta-elemene; (-)-beta-Elemene; Elemene; 1-ethenyl-1-methyl-2,4-bis(prop-1-en-2-yl)cyclohexane ; Cyclohexane, 2,4-diisopropenyl-1-methyl-1-vinyl-, (1S,2S,4R)-;	2.97	515-13-9 100762-52-5	$C_{15}H_{24}$ / 204.35106		Sesquiterpene
16	4a,5-Dimethyl-3-(prop-1-en-2-yl)-1,2,3,4,4a,5,6,7-octahydronaphthalen-1-ol; 1-Naphthalenol, 1,2,3,4,4a,5,6,7-octahydro-4a,5-dimethyl-3-(1-methylethenyl)-;	1.47	61847-19-6	$C_{15}H_{24}O$ / 220.3505		Sesquiterpenoid
17	p-anisaldehyde; 4-Methoxybenzaldehyde ; Anisic aldehyde; Anisaldehyde;	1.36	123-11-5	$C_8H_8O_2$ / 136.15		Oxygenated Monoterpene derivative
18	2-(4a,8-Dimethyl-1,2,3,4,4a,5,6,7-octahydronaphthalen-2-yl)-prop-2-en-1-ol; gamma-costol;	1.29	N/A	$C_{15}H_{24}O$ / 220.3505		Sesquiterpenoid

19	Spathulenol; espatulenol; (+)-Spathulenol; 1H-Cycloprop(e)azulen-7-ol, decahydro-1,1,7-trimethyl-4-methylene-, (1aR-(1a α ,4a α ,7 β ,7a β ,7b α))-; (1aR,4aR,7S,7aR,7bR)-1,1,7-trimethyl-4-methylidene-1a,2,3,4a,5,6,7a,7b-octahydrocyclopropa[h]azulen-7-ol;	1.27	6750-60-3	C ₁₅ H ₂₄ O/ 220.35046		Sesquiterpenoid
20	gamma-Gurjunenepoxide-(2); 2-(3,8-Dimethyl-1,2,3,5,6,7,8,8a-octahydro-5-azulenyl)-2-methyloxirane; 2-(3,8-dimethyl-1,2,3,5,6,7,8,8a-octahydroazulen-5-yl)-2-methyl-oxirane;	1.20	184705-51-9	C ₁₅ H ₂₄ O/ 220.35046		Sesquiterpenoid
21	Alloaromadendrene oxide-(1); Aromadendrene oxide; Aromadendrene oxide-(1); Aromadendrene oxide-(2); Alloaromadendrene oxide-(2);	1.06	N/A	C ₁₅ H ₂₄ O/ 220.35046		Sesquiterpenoid
22	Guai-1(10)-en-11-ol; 5-Azulenemethanol, 1,2,3,3a,4,5,6,7-octahydro-.alpha.,.alpha.,3,8-tetramethyl-, [3S-(3.alpha.,3a.beta.,5.alpha.)]-; 2-(3,8-Dimethyl-1,2,3,3a,4,5,6,7-octahydro-5-azulenyl)-2-propanol #; 2-[(3S,3aR,5S)-3,8-dimethyl-1,2,3,3a,4,5,6,7-octahydroazulen-5-yl]propan-2-ol;	1.02	N/A	C ₁₅ H ₂₆ O/ 222.37		Sesquiterpene alcohol
23	2-Hydroxymethyl-2,6,8,8-tetramethyltricyclo[5.2.2.0(1,6)]undecane	0.99	N/A	C ₁₆ H ₂₈ O	N/A	Oxygenated Sesquiterpene derivative

24	Kessane; 1,4-Ethano-1H-cyclopent(c)oxepin, octahydro-1,3,3,6-tetramethyl-, (1S-(1alpha,4alpha,5abeta,6alpha,8aalpha))-;	0.92	3321-66-2	C ₁₅ H ₂₆ O/ 222.372		Sesquiterpene alcohol
25	cis-(Z)-alpha-Bisabolene epoxide; (2R,3S)-2-methyl-3-(3-methylbut-2-enyl)-2-(4-methylcyclohex-3-en-1-yl)oxirane ;	0.90	N/A	C ₁₅ H ₂₄ O/ 220.35		Sesquiterpenoid
26	2-Methylchromone; 2-methyl-4H-1-benzopyran-4-one; Chromone, 2-methyl-; 2-Methyl-4H-chromen-4-one; 2-methylchromen-4-one ;	0.89	5751-48-4	C ₁₀ H ₈ O ₂ / 160.17		Chromone derivative
27	<u>Elemol; 2-(3-Isopropenyl-4-methyl-4-vinylcyclohexyl)-2-propanol; (1S,2S,4R)-(-)-alpha,alpha-Dimethyl-1-vinyl-o-menth-8-ene-4-methanol; 2-[(1R,3R,4S)-4-ethenyl-4-methyl-3-prop-1-en-2-yl-cyclohexyl]propan-2-ol;</u>	0.85	639-99-6 8024-27-9	C ₁₅ H ₂₆ O/ 222.366		Sesquiterpene alcohol
28	1(2H)-Naphthalenone, 3,4,4a,5,6,7-hexahydro-4a,5-dimethyl-3-(1-methylethenyl)-, [3S-(3α,4α,5α)]-; (3S,4aR,5S)-4a,5-Dimethyl-3-(prop-1-en-2-yl)-3,4,4a,5,6,7-hexahydronaphthalen-1(2H)-one;	0.80	562-23-2	C ₁₅ H ₂₂ O/ 218.3346		Oxygenated Sesquiterpene derivative
Total		76.47				

Notes: - IUPAC stands for International Union of Pure and Applied Chemistry,
- CAS stands for Chemical Abstracts Service
- (*) IUPAC name written in bold letter, compound names are separated by semi-colon (;)

REMARK:

Considering the presence in CGKi of chromones, monoterpenes, sesquiterpenes and their oxygenated compounds, we have the following table:

Class of compound	Quantity of compound	Total content (%)	Symbol
Monoterpene & its derivative	0	0	m
Oxygenated monoterpene & its derivative	3	13.44	m _o
Sesquiterpene & its derivative	2	4.73	s
Oxygenated sesquiterpene & its derivative	18	42.41	s _o
Chromone & its derivative	5	15.89	c
Total	28	76.47	

From the table above we can make the following remark: In CGKi, the ratio $\alpha = \frac{so+mo}{s+m} = 11.81$ is relatively big. Please be noted that the bigger the α , the higher the quality of agarwood (<https://actascientific.com/ASAG/pdf/ASAG-03-0622.pdf> or <https://agarwood.ning.com/profiles/blogs/a-suggested-method-for-evaluation-of-the-quality-of-sandalwood>). So we can appreciate that CGKi is a premium agarwood. However, CGK cannot be viewed as a traditional kynam (or wild kynam) because:

- the total content of 76.47% is still small, which means that many compounds have not been detected and identified yet.
- in the test report there were no important compounds of wild kynam such as 2,6-ditert-butyl-4-methylphenol (CAS# 128-37-0, sesquiterpenoid) and (4R,5R,7R)-1(10)-Spirovetiven-11-ol-2-one (spirovetivane-type sesquiterpene), for details please refer to <http://agarwood.ning.com/profiles/blogs/differences-between-kynam-and-normal-agarwood-continued>.
- The mass-loss rate of CGKi was lower than that of wild kynam (it was said in <https://doi.org/10.1016/j.fitote.2020.104493>).

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Explanation by Dinh xuan Ba.

For SECOIN Corporation



General Director
Ms. Hana (Vo thi Lien Huong)