

Table S1 Component Analysis of Pine Needle Essential Oil by GC-IMS

No.	CAS	Compound	Molecular formula	Relative peak area	Relative standard deviation
Terpenoids (54.643%)					
1	76-49-3	Bornyl acetate	C ₁₂ H ₂₀ O ₂	31.874	7.94%
2	106-23-0	β-Citronellal	C ₁₀ H ₁₈ O	5.461	2.46%
3	60047-17-8	Furan linalool oxide	C ₁₀ H ₁₈ O ₂	3.304	0.87%
4	475-20-7	Junipene	C ₁₅ H ₂₄	2.421	7.03%
5	13466-78-9	δ-3-carene	C ₁₀ H ₁₆	1.728	1.89%
6	13877-91-3	β-ocimene	C ₁₀ H ₁₆	1.706	4.69%
7	80-56-8	α-Pinene	C ₁₀ H ₁₆	1.483	1.72%
8	99-86-5	α-Terpinene	C ₁₀ H ₁₆	2.467	2.14%
9	76-22-2	Camphor	C ₁₀ H ₁₆ O	1.342	2.08%
10	127-91-3	β-Pinene	C ₁₀ H ₁₆	0.850	1.82%
11	13886-33-2	(+)-limonene	C ₁₀ H ₁₆	0.845	4.27%
12	79 - 92 - 5	Camphene	C ₁₀ H ₁₆	0.522	2.30%
13	123-35-3	β-myrcene	C ₁₀ H ₁₆	0.395	1.90%
14	78-70-6	(R/S)-linalool	C ₁₀ H ₁₈ O	0.246	19.42%
Aldehydes (21.953%)					
15	6728-26-3	(E)-2-hexen-1-al	C ₇ H ₁₂ O	3.743	4.05%
16	100-52-7	Benzaldehyde	C ₇ H ₆ O	2.650	34.30%
17	66-25-1	1-hexanal	C ₆ H ₁₂ O	2.637	1.17%
18	18829-55-5	(E)-2-Heptenal	C ₇ H ₁₂ O	1.390	4.01%
19	123-38-6	Propanal	C ₃ H ₆ O	1.368	4.58%
20	110-62-3	n-Pentanal	C ₅ H ₁₀ O	1.210	2.16%
21	1576-87-0	(E)-2-Pentenal	C ₅ H ₈ O	1.176	2.34%
22	2548-87-0	(E)-2-octenal	C ₉ H ₁₆ O	1.068	2.23%
23	124-13-0	1-octanal	C ₈ H ₁₆ O	1.014	3.92%
24	107-86-8	3-Methyl-2-butenal	C ₅ H ₈ O	1.006	3.27%
25	124-19-6	1-nonanal	C ₉ H ₁₈ O	0.957	10.76%
26	111-71-7	Heptaldehyde	C ₇ H ₁₄ O	0.608	3.45%
27	98-01-1	2-furaldehyde	C ₇ H ₁₀ O	0.481	5.62%
28	18829-56-6	(E)-2-nonenal	C ₁₀ H ₁₈ O	0.468	2.49%
29	78-85-3	2-methyl-2-pentenal	C ₇ H ₁₂ O	0.423	6.77%
30	4313-03-5	(E, E)-2,4-hexadienal	C ₆ H ₈ O	0.380	3.42%
31	123-72-8	Butanal	C ₄ H ₈ O	0.339	3.89%
32	6728-31-0	(Z)-4-heptenal	C ₇ H ₁₂ O	0.324	4.74%
34	110-43-0	2-Heptanone	C ₇ H ₁₄ O	0.259	1.65%
35	505-57-7	2-Hexenal	C ₆ H ₁₀ O	0.131	7.86%
36	590-86-3	3-Methyl butanal	C ₅ H ₁₀ O	0.045	18.63%

Alcohols (12.078%)					
37	928-95-0	(E)-2-Hexen-1-ol	C ₆ H ₁₂ O	3.238	4.05%
38	111-27-3	1 -hexanol	C ₆ H ₁₄ O	2.648	3.11%
39	71-36-3	1- butanol	C ₄ H ₁₀ O	2.054	0.85%
40	71-41-0	1-Pentanol	C ₅ H ₁₂ O	1.739	3.08%
41	67-63-0	2-Propanol	C ₃ H ₈ O	1.103	4.47%
42	64-17-5	Ethanol	C ₂ H ₆ O	0.958	2.18%
43	3391-86-4	1-Octen-3-ol	C ₈ H ₁₆ O	0.339	13.84%
Ketones (4.502%)					
44	67-64-1	2-propanone	C ₃ H ₆ O	2.227	2.10%
45	110-93-0	2-methyl-2-hepten- 6-one	C ₈ H ₁₄ O	1.338	6.97%
46	78-93-3	2-Butanone	C ₄ H ₈ O	0.515	0.44%
47	107-87-9	2-Pentanone	C ₅ H ₁₀ O	0.212	1.18%
48	4312-99-6	1-Octen-3-one	C ₈ H ₁₄ O	0.210	2.62%
Esters (2.315%)					
49	97-62-1	Ethyl 2-methy lpropanoate	C ₆ H ₁₂ O ₂	0.948	4.43%
50	106-36-5	Propanoic acid propyl ester	C ₆ H ₁₂ O ₂	0.688	4.49%
51	109-94-4	Ethyl formate	C ₃ H ₆ O ₂	0.293	6.16%
52	105-54-4	Butanoic acid ethyl	C ₆ H ₁₂ O ₂	0.247	4.74%
53	141-78-6	Acetic acid ethyl	C ₄ H ₈ O ₂	0.138	4.02%
Heterocyclic compounds (1.526%)					
54	13925-03-6	2-ethyl-6- methyldiazepine	C ₇ H ₁₀ N ₂	0.823	6.04%
55	3777-69-3	2-pentyl furan	C ₉ H ₁₄ O	0.702	4.68%
Acid (1.496%)					
56	64-19-7	Acetic acid	C ₂ H ₄ O ₂	1.496	5.83%
Sulfide (0.590%)					
57	2179-57-9	allyl disulfide	C ₆ H ₁₀ S ₂	0.590	5.41%