

Supplementary material

Fig. S1. Heatmap representation of the analyzed Volatile organic compounds in Frantoio cultivar during all the analysis times. Colors represent the foldchange as: blue color: higher in hydrocooler; red color: lower in hydrocooler. C: Control. Hy: Hydrocooler-treated samples. t0: fresh oil. t1: stored oil for 1 year. Analysis was performed in triplicate per year and cultivar. The asterisks indicate the significant differences between the treatment and control ($p \leq 0.05$)

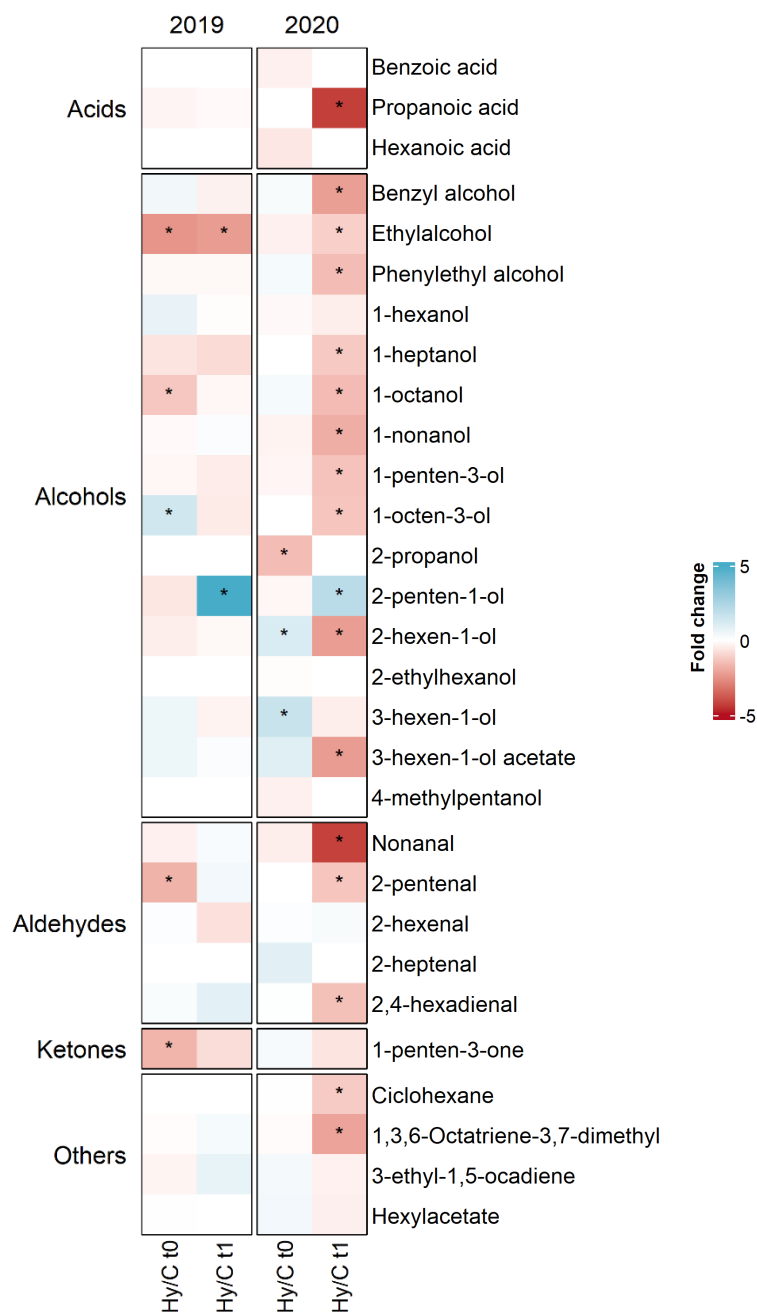


Fig. S2. Heatmap representation of the analyzed Volatile organic compounds in Leccino cultivar during all the analysis times. Colors represent the foldchange as: blue color: higher in hydrocooler; red color: lower in hydrocooler. C: Control. Hy: Hydrocooler-treated samples. t0: fresh oil. t1: stored oil for 1 year. Analysis was performed in triplicate per year and cultivar. The asterisks indicate the significant differences between the treatment and control ($p \leq 0.05$)

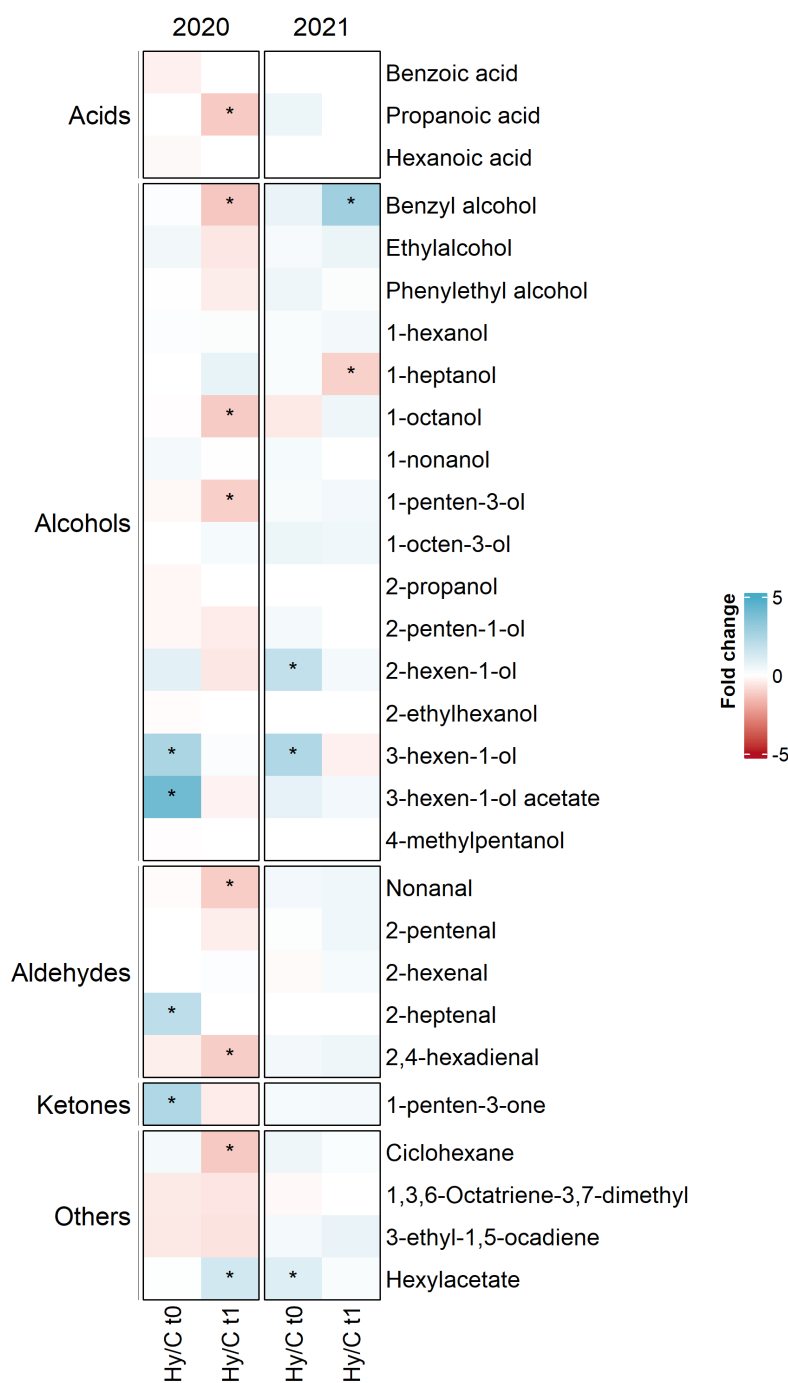


Table S1. Yield of extraction (%) of Frantoio and Leccino comparing control olives and olives treated with hydrocooler.

Cultivar	Control	Hydrocooler
Frantoio	14.10 ± 1.25	13.25 ± 1.53
Leccino	13.75 ± 0.92	14.37 ± 1.05

Table S2. Detected phenolic compounds (mg/kg) by RP-HPLC-DAD in the fresh oil. C: Control. Hy: Hydrocooler treated samples. AHLA: Aldehydic Hydroxylic Ligstroside Aglycon, AHOA: Aldehydic Hydroxylic Oleuropein Aglycon, DDMOA: Dialdehyde Decarboxy Methyl Oleuropein Aglycon, DDMLA: Dialdehyde Decarboxy Methyl Ligstroside Aglycon, DAL: Dialdehyde Aglicone Ligstroside, DOA: Dialdehyde Oleuropein Aglycon, OAHLA: Oxidized Aldehydic Hydroxylic Ligstroside Aglycon, OAHOA: Oxidized Aldehydic Hydroxylic Oleuropein Aglycon, ODDMOA: Oxidized Dialdehyde Decarboxy Methyl Oleuropein Aglycon, ODDMLA: Oxidized Dialdehyde Decarboxy Methyl Ligstroside Aglycon. Oleuropein: Oleuropein hydrolyzed derivatives

Cultivar	Frantoio				Leccino			
Year	2019		2020		2020		2021	
Treatment	C	Hy	C	Hy	C	Hy	C	Hy
Apigenin	3.000 ± 0.000	4.000 ± 0.000	8.730 ± 1.290	12.225 ± 0.295	8.205 ± 0.965	9.320 ± 0.830	9.247 ± 3.933	9.678 ± 5.554
Methyl luteolin	9.000± 0.000	3.000 ± 0.000	14.900 ± 0.580	14.585 ± 2.035	10.270 ± 0.540	8.485 ± 1.165	9.021 ± 4.011	8.634 ± 5.080
Luteoline	4.000± 0.000	3.000 ± 0.000	13.140 ± 1.440	18.305 ± 1.355	8.640 ± 1.050	7.390 ± 1.540	6.838 ± 4.262	11.424 ± 1.163
Cinnamic acid	15.000 ± 0.000	19.000 ± 0.000	5.350 ± 0.060	11.30 ± 1.280	3.530 ± 0.260	4.490 ± 1.390	10.514 ± 5.373	18.410 ± 3.652
Ferulic acid	2.000 ± 0.000	4.000 ± 0.000	2.115 ± 0.315	5.505 ± 0.105	3.785 ± 0.265	4.255 ± 0.565	1.921 ± 0.933	2.940 ± 1.225
o-cumaric acid	1.000 ± 0.000	2.000 ± 0.000	2.770 ± 0.310	2.200 ± 0.080	3.810 ± 0.350	2.160 ± 0.560	1.967 ± 0.508	2.195 ± 0.970
p-cumaric acid	1.000 ± 0.000	1.000 ± 0.000	1.930 ± 0.090	2.725 ± 0.295	2.780 ± 0.320	1.560 ± 0.080	3.034 ± 1.421	1.123 ± 0.820
Vanillic+caffeic acids	1.000 ± 0.000	1.000 ± 0.000	2.500 ± 0.150	2.120 ± 0.160	2.015 ± 0.555	1.900 ± 0.170	2.304 ± 1.040	2.038 ± 1.172
Vanilline	2.000 ± 0.000	2.000 ± 0.000	3.130 ± 0.400	3.475 ± 0.035	3.550 ± 0.100	2.765 ± 0.445	3.399 ± 0.252	4.323 ± 0.978
Pinoresinol	70.000 ± 0.000	22.000 ± 0.000	30.070 ± 2.800	27.665 ± 2.285	16.310 ± 1.180	17.360 ± 0.490	21.603 ± 11.734	27.886 ± 0.625
AHLA	11.000 ± 0.000	12.000 ± 0.000	84.495 ± 0.485	85.710 ± 0.660	24.270 ± 1.950	24.460 ± 1.540	27.772 ± 30.065	24.502 ± 29.604
AHOA	114.000 ± 0.000	89.000 ± 0.000	9.815 ± 0.335	14.435 ± 0.495	6.420 ± 0.320	7.310 ± 0.200	105.185 ± 36.256	107.874 ± 83.764
DDMOA	95.000 ± 0.000	116.000 ± 0.000	67.615 ± 2.765	41.295 ± 0.995	156.440 ± 1.970	151.700 ± 3.110	53.045 ± 79.651	58.912 ± 87.187
DDMLA	73.000 ± 0.000	51.000 ± 0.000	55.365 ± 1.165	51.265 ± 0.055	73.705 ± 1.655	76.785 ± 1.555	26.704 ± 42.105	30.667 ± 44.453
DAL	16.000 ± 0.000	16.000 ± 0.000	59.580 ± 3.590	78.175 ± 4.215	10.285 ± 1.625	9.125 ± 0.055	15.153 ± 18.235	20.521 ± 24.007
DOA	15.000 ± 0.000	8.000± 0.000	11.050 ± 2.310	19.935 ± 2.945	11.945 ± 1.085	11.815 ± 0.865	20.448 ± 7.914	27.001 ± 7.708
Hydroxytyrosol	12.000 ± 0.000	3.000 ± 0.000	14.945 ± 0.245	14.740 ± 0.520	5.825 ± 0.245	5.945 ± 0.655	10.158 ± 0.809	11.148 ± 2.157
Hydroxytyrosol acetate	0.000 ± 0.000	1.000 ± 0.000	2.025 ± 0.225	2.285 ± 0.175	1.635 ± 0.105	1.565 ± 0.045	1.381 ± 0.624	2.359 ± 0.384
Oleuropein	7.000 ± 0.000	12.000 ± 0.000	9.100 ± 3.050	7.895 ± 0.785	9.550 ± 0.020	9.210 ± 1.090	105.695 ± 75.428	120.875 ± 89.406
ODDMLA	9.000 ± 0.000	11.000 ± 0.000	7.540 ± 1.600	7.595 ± 0.225	7.420 ± 0.330	7.615 ± 0.125	49.953 ± 33.738	67.30 ± 51.119
ODDMOA	8.000 ± 0.000	9.000 ± 0.000	2.535 ± 0.325	2.125 ± 0.115	2.675 ± 0.345	3.295 ± 0.105	2.389 ± 0.783	1.858 ± 1.148
OAHOA	15.000 ± 0.000	16.000 ± 0.000	25.670 ± 1.870	30.825 ± 1.425	22.305 ± 1.285	22.08 ± 1.30	15.644 ± 3.803	22.923 ± 2.971
OAHLA	57.000 ± 0.000	48.000 ± 0.000	230.075 ± 2.175	220.225 ± 1.095	105.565 ± 0.185	99.645 ± 4.945	79.788 ± 38.748	114.776 ± 57.1
Tyrosol	9.000 ± 0.000	6.000 ± 0.000	9.635 ± 0.655	9.400 ± 0.360	4.395 ± 0.585	5.315 ± 0.325	5.578 ± 0.798	7.333 ± 0.717

Table S3. Detected phenolic compounds (mg/kg) by RP-HPLC-DAD in the stored oil. C: Control. Hy: Hydrocooler treated samples. AHLA: Aldehydic Hydroxylic Ligstroside Aglycon, AHOA: Aldehydic Hydroxylic Oleuropein Aglycon, DDMOA: Dialdehyde Decarboxy Methyl Oleuropein Aglycon, DDMLA: Dialdehyde Decarboxy Methyl Ligstroside Aglycon, DAL: Dialdehyde Aglicone Ligstroside, DOA: Dialdehyde Oleuropein Aglycon, OAHLA: Oxidized Aldehydic Hydroxylic Ligstroside Aglycon, OAHOA: Oxidized Aldehydic Hydroxylic Oleuropein Aglycon, ODDMOA: Oxidized Dialdehyde Decarboxy Methyl Oleuropein Aglycon, ODDMLA: Oxidized Dialdehyde Decarboxy Methyl Ligstroside Aglycon. Oleuropein: Oleuropein hydrolyzed derivatives

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Tyrosol	9.000 ± 0.000	6.000 ± 0.000	9.635 ± 0.655	9.400 ± 0.360	4.395 ± 0.585	5.315 ± 0.325	5.578 ± 0.798	7.333 ± 0.717

Table S4. Detected volatile organic compounds (relative intensity) by HS-SPME/GC-MS in the fresh oil

Cultivar	Frantoio				Leccino			
Year	2019		2020		2020		2021	
Treatment	C	Hy	C	Hy	C	Hy	C	Hy
Benzoic acid	0.000 ± 0.000	0.000 ± 0.000	0.007 ± 0.000	0.005 ± 0.000	0.005 ± 0.001	0.004 ± 0.001	0.000 ± 0.000	0.000 ± 0.000
Hexanoic acid	0.007 ± 0.001	0.006 ± 0.001	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.001 ± 0.000	0.002 ± 0.000
Propanoic acid	0.000 ± 0.000	0.000 ± 0.000	0.069 ± 0.021	0.046 ± 0.009	0.014 ± 0.001	0.012 ± 0.002	0.000 ± 0.000	0.000 ± 0.000
1-Hexanol	0.006 ± 0.000	0.007 ± 0.001	0.006 ± 0.000	0.006 ± 0.000	0.007 ± 0.001	0.007 ± 0.000	0.005 ± 0.000	0.006 ± 0.001
1-Heptanol	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
1-Octanol	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.001 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.001 ± 0.000	0.001 ± 0.000
1-Nonanol	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.001 ± 0.000	0.000 ± 0.000	0.001 ± 0.000
1-Octen-3-ol	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.001 ± 0.000
1-Penten-3-ol	0.018 ± 0.001	0.017 ± 0.001	0.014 ± 0.001	0.012 ± 0.001	0.007 ± 0.000	0.006 ± 0.000	0.011 ± 0.000	0.013 ± 0.001
2-ethyl-1-Hexanol	0.000 ± 0.000	0.000 ± 0.000	0.004 ± 0.001	0.004 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
2-Hexen-1-ol	0.003 ± 0.000	0.002 ± 0.000	0.005 ± 0.000	0.011 ± 0.003	0.008 ± 0.002	0.015 ± 0.002	0.012 ± 0.000	0.000 ± 0.000
2-Penten-1-ol	0.002 ± 0.000	0.002 ± 0.000	0.008 ± 0.000	0.007 ± 0.000	0.006 ± 0.000	0.006 ± 0.000	0.001 ± 0.000	0.001 ± 0.000
2-Propanol	0.000 ± 0.000	0.000 ± 0.000	0.016 ± 0.001	0.005 ± 0.001	0.001 ± 0.000	0.001 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
3-Hexen-1-ol	0.018 ± 0.001	0.021 ± 0.002	0.018 ± 0.006	0.075 ± 0.074	0.015 ± 0.003	0.085 ± 0.02	0.035 ± 0.001	0.179 ± 0.013
3-Hexen-1-ol acetate	0.012 ± 0.003	0.015 ± 0.003	0.039 ± 0.01	0.074 ± 0.008	0.003 ± 0.000	0.055 ± 0.006	0.01 ± 0.000	0.017 ± 0.001
4-Methyl-1-Pentanol	0.000 ± 0.000	0.000 ± 0.000	0.009 ± 0.003	0.007 ± 0.002	0.006 ± 0.000	0.006 ± 0.001	0.000 ± 0.000	0.000 ± 0.000
Benzyl alcohol	0.001 ± 0.000	0.001 ± 0.000	0.003 ± 0.001	0.003 ± 0.000	0.002 ± 0.000	0.002 ± 0.000	0.004 ± 0.001	0.005 ± 0.000
Ethylalcohol	0.009 ± 0.000	0.007 ± 0.000	0.025 ± 0.003	0.019 ± 0.002	0.233 ± 0.004	0.31 ± 0.025	0.007 ± 0.000	0.008 ± 0.001
Phenylethyl alcohol	0.004 ± 0.002	0.004 ± 0.001	0.008 ± 0.001	0.009 ± 0.001	0.006 ± 0.001	0.006 ± 0.001	0.014 ± 0.002	0.019 ± 0.001
2,4-Hexadienal	0.003 ± 0.000	0.004 ± 0.000	0.009 ± 0.002	0.009 ± 0.002	0.005 ± 0.000	0.004 ± 0.000	0.005 ± 0.000	0.006 ± 0.001
2-Heptenal	0.000 ± 0.000	0.000 ± 0.000	0.007 ± 0.001	0.012 ± 0.001	0.005 ± 0.000	0.021 ± 0.004	0.000 ± 0.000	0.000 ± 0.000
2-Hexenal	0.747 ± 0.015	0.764 ± 0.012	0.597 ± 0.026	0.65 ± 0.011	0.686 ± 0.007	0.683 ± 0.007	0.784 ± 0.011	0.728 ± 0.02
2-Pentenal	0.002 ± 0.000	0.002 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.001 ± 0.000	0.001 ± 0.000
Nonanal	0.006 ± 0.003	0.006 ± 0.000	0.008 ± 0.000	0.006 ± 0.001	0.006 ± 0.000	0.006 ± 0.000	0.012 ± 0.001	0.016 ± 0.002
1-Penten-3-one	0.059 ± 0.003	0.044 ± 0.001	0.015 ± 0.004	0.017 ± 0.003	0.01 ± 0.000	0.051 ± 0.009	0.003 ± 0.000	0.004 ± 0.001
1,3,6-Octatriene-3,7-dimethyl	0.000 ± 0.000	0.000 ± 0.000	0.01 ± 0.003	0.009 ± 0.002	0.005 ± 0.000	0.003 ± 0.001	0.000 ± 0.000	0.000 ± 0.000
3-Ethyl-1,5-octadiene	0.006 ± 0.002	0.006 ± 0.000	0.007 ± 0.001	0.009 ± 0.001	0.004 ± 0.000	0.003 ± 0.000	0.002 ± 0.000	0.003 ± 0.000
Cyclohexane	0.000 ± 0.000	0.000 ± 0.000	0.092 ± 0.024	0.089 ± 0.011	0.152 ± 0.028	0.192 ± 0.030	0.046 ± 0.002	0.067 ± 0.008
Hexyl acetate	0.003 ± 0.001	0.003 ± 0.000	0.005 ± 0.001	0.006 ± 0.001	0.001 ± 0.000	0.001 ± 0.000	0.001 ± 0.000	0.001 ± 0.000

Table S5. Detected volatile organic compounds (relative intensity) by HS-SPME/GC-MS in the stored oil

Cultivar	Frantoio				Leccino			
Year	2019		2020		2020		2021	
Treatment	C	Hy	C	Hy	C	Hy	C	Hy
Benzoic acid	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Hexanoic acid	0.005 ± 0.002	0.004 ± 0.001	0.028 ± 0.005	0.007 ± 0.011	0.003 ± 0.005	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Propanoic acid	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
1-Hexanol	0.002 ± 0.001	0.002 ± 0.001	0.003 ± 0.000	0.003 ± 0.002	0.003 ± 0.001	0.003 ± 0.000	0.009 ± 0.001	0.011 ± 0.000
1-Heptanol	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.001 ± 0.001	0.000 ± 0.000
1-Octanol	0.442 ± 0.033	0.386 ± 0.018	0.002 ± 0.000	0.001 ± 0.001	0.000 ± 0.000	0.000 ± 0.000	0.007 ± 0.001	0.011 ± 0.000
1-Nonanol	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
1-Octen-3-ol	0.001 ± 0.000	0.001 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.016 ± 0.003	0.022 ± 0.002
1-Penten-3-ol	0.012 ± 0.002	0.009 ± 0.001	0.013 ± 0.000	0.008 ± 0.006	0.003 ± 0.004	0.001 ± 0.000	0.001 ± 0.000	0.001 ± 0.000
2-ethyl-1-Hexanol	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
2-Hexen-1-ol	0.027 ± 0.006	0.024 ± 0.001	0.023 ± 0.002	0.007 ± 0.008	0.005 ± 0.004	0.003 ± 0.000	0.003 ± 0.001	0.003 ± 0.000
2-Penten-1-ol	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
2-Propanol	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
3-Hexen-1-ol	0.013 ± 0.006	0.01 ± 0.001	0.009 ± 0.000	0.007 ± 0.003	0.006 ± 0.002	0.006 ± 0.000	0.006 ± 0.003	0.004 ± 0.001
3-Hexen-1-ol acetate	0.000 ± 0.000	0.000 ± 0.000	0.004 ± 0.000	0.004 ± 0.003	0.001 ± 0.001	0.000 ± 0.000	0.008 ± 0.001	0.011 ± 0.000
4-Methyl-1-Pentanol	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
Benzyl alcohol	0.014 ± 0.001	0.011 ± 0.002	0.003 ± 0.000	0.001 ± 0.001	0.001 ± 0.002	0.000 ± 0.000	0.006 ± 0.005	0.01 ± 0.000
Ethylalcohol	0.015 ± 0.001	0.003 ± 0.000	0.003 ± 0.000	0.002 ± 0.001	0.000 ± 0.000	0.000 ± 0.000	0.019 ± 0.005	0.029 ± 0.005
Phenylethyl alcohol	0.004 ± 0.000	0.003 ± 0.001	0.008 ± 0.000	0.004 ± 0.003	0.004 ± 0.002	0.002 ± 0.000	0.031 ± 0.004	0.034 ± 0.003
2,4-Hexadienal	0.001 ± 0.000	0.001 ± 0.001	0.004 ± 0.000	0.002 ± 0.002	0.001 ± 0.002	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
2-Heptenal	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
2-Hexenal	0.664 ± 0.013	0.409 ± 0.009	0.365 ± 0.007	0.434 ± 0.049	0.451 ± 0.051	0.478 ± 0.001	0.341 ± 0.039	0.423 ± 0.04
2-Pentenal	0.000 ± 0.000	0.000 ± 0.000	0.001 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.003 ± 0.000	0.003 ± 0.000
Nonanal	0.011 ± 0.002	0.013 ± 0.002	0.003 ± 0.001	0.001 ± 0.001	0.001 ± 0.001	0.000 ± 0.000	0.001 ± 0.000	0.001 ± 0.000
1-Penten-3-one	0.036 ± 0.002	0.021 ± 0.002	0.003 ± 0.000	0.003 ± 0.002	0.001 ± 0.001	0.000 ± 0.000	0.006 ± 0.001	0.008 ± 0.001
1,3,6-Octatriene-3,7-dimethyl	0.001 ± 0.001	0.001 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000 ± 0.000
3-Ethyl-1,5-octadiene	0.004 ± 0.001	0.006 ± 0.001	0.002 ± 0.000	0.002 ± 0.002	0.000 ± 0.000	0.000 ± 0.000	0.003 ± 0.001	0.005 ± 0.001
Cyclohexane	0.000 ± 0.000	0.000 ± 0.000	0.028 ± 0.001	0.015 ± 0.011	0.021 ± 0.026	0.005 ± 0.001	0.002 ± 0.000	0.002 ± 0.000
Hexyl acetate	0.016 ± 0.002	0.016 ± 0.002	0.001 ± 0.000	0.001 ± 0.001	0.000 ± 0.000	0.000 ± 0.000	0.001 ± 0.000	0.002 ± 0.000