Table S2. Peak information, relative intensity and *p* -value of volatile compounds by ethyl acetate extraction

Compound name	RI[a]	Quantitative *m/z*	Relative peak height (mean ± SD)[b]					Reliability[d]	*p* -value[c]	
			0 week	18 weeks						
				Control	LAB + EtOH	Acid + Yeast	Acid + EtOH		Control vs. LAB + EtOH	Control vs. Acid + Yeast
1-Propanol		59	0.002±0.00	0.208±0.004	0.111±0.004	0.189±0.011	0.112±0.004	C	< 0.01 *	0.074
2-Methyl-1-propanol (Isobutyl alcohol)		74	0.019±0.00	0.168±0.006	0.023±0.001	0.131±0.009	0.021±0.000	A, C	< 0.01 *	0.010
1-Butanol		56	0.004±0.00	1.596±0.016	0.006±0.000	1.672±0.131	0.005±0.001	A	< 0.01 *	0.502
3-Methyl-1-butanol (Isoamyl alcohol)	1205.48	55	0.072±0.00	0.994±0.081	0.093±0.009	0.788±0.069	0.078±0.005	A, C	< 0.01 *	0.052
3-Hydroxy-2-butanone (Acetoin)	1274.97	88	0.002±0.00	0.675±0.021	0.007±0.001	1.037±0.041	0.003±0.000	A, B, C	< 0.01 *	< 0.01 *
1-Hydroxy-2-propanone (Acetol)	1287.97	74	0.002±0.00	0.012±0.001	0.012±0.001	0.016±0.001	0.016±0.001	A, B, C	0.501	< 0.01 *
Ethyl lactate	1334.19	75	0.002±0.00	1.078±0.015	1.109±0.024	1.216±0.067	1.082±0.104	A, B, C	0.204	0.048
1-Hydroxy-2-butanone	1360.78	57	0.002±0.00	0.105±0.004	0.020±0.001	0.120±0.006	0.015±0.001	C	< 0.01 *	0.040
Acetic acid	1419.88	59	0.003±0.00	0.061±0.002	0.057±0.004	0.052±0.008	0.055±0.008	A, B, C	0.158	0.154
3-(Methylthio)-1-propanal (Methional)	1440.77	57	0.025±0.00	0.021±0.000	0.022±0.000	0.021±0.000	0.021±0.001	A, B, C	< 0.01 *	0.191
2-Furancarboxaldehyde (Furfural)	1448.22	96	0.002±0.00	0.067±0.002	0.028±0.001	0.077±0.006	0.033±0.007	A, B, C	< 0.01 *	0.097
2,3-Butanediol	1525.25	57	0.002±0.00	0.460±0.053	0.032±0.000	0.447±0.041	0.027±0.003	A, B, C	< 0.01 *	0.808
2-Methylpropanoic acid (Isobutyric acid)	1553.84	73	0.012±0.00	0.135±0.005	0.147±0.008	0.123±0.004	0.128±0.021	B, C	0.144	0.053
Dihydro-5-methyl-2(3*H*)-furanone (*gamma* -Valerolactone)	1570.28	56	0.002±0.00	0.016±0.001	0.002±0.000	0.020±0.002	0.002±0.001	A, C	< 0.01 *	0.045
Dihydro-2(3*H*)-Furanone (*gamma* -Butyrolactone)	1606.45	86	0.002±0.00	0.028±0.001	0.019±0.001	0.019±0.002	0.014±0.001	A, B, C	< 0.01 *	< 0.01 *
Butanoic acid (Butyric acid)	1612.62	60	0.004±0.00	0.067±0.003	0.043±0.003	0.054±0.001	0.043±0.002	B, C	< 0.01 *	< 0.01 *
Phenylacetaldehyde	1624.42	91	0.004±0.00	0.068±0.002	0.058±0.005	0.069±0.003	0.057±0.003	A, C	0.056	0.652
2-Furanmethanol (Furfuryl alcohol)	1643.06	98	0.002±0.00	0.127±0.011	0.06±0.005	0.103±0.009	0.065±0.021	A, B, C	< 0.01 *	0.077
3-Methylbutanoic acid (Isovaleric acid)	1654.63	60	0.167±0.01	0.499±0.027	0.561±0.032	0.458±0.033	0.530±0.039	A, B, C	0.109	0.242
2-Methylbutanoic acid	1655.64	74	0.054±0.00	0.147±0.005	0.162±0.002	0.139±0.009	0.153±0.016	A, B, C	0.012 *	0.313
5-Ethyldihydro-2(3*H*)-furanone (*gamma* -hexalactone)	1679.10	85	0.000±0.00	0.006±0.000	0.003±0.000	0.005±0.000	0.003±0.000	A, B, C	< 0.01 *	< 0.01 *
3-Methyl-2(5*H*)-furanone	1695.06	69	0.002±0.00	0.055±0.001	0.002±0.000	0.063±0.008	0.002±0.001	B, C	< 0.01 *	0.309
3-(Methylthio)-1-propanol (Methionol)	1698.43	106	0.017±0.00	0.173±0.006	0.045±0.001	0.153±0.010	0.040±0.002	A, B, C	< 0.01 *	0.075
2(5*H*)-furanone	1730.55	55	0.002±0.00	0.012±0.001	0.012±0.000	0.014±0.001	0.014±0.000	A, C	0.419	0.158
2-Butenoic acid	1754.92	86	0.002±0.00	0.016±0.001	0.006±0.001	0.020±0.004	0.006±0.000	B, C	< 0.01 *	0.268
2-Hydroxy-3-methyl-2-cyclopenten-1-one (Cyclotene)	1805.57	112	0.002±0.00	0.015±0.000	0.010±0.001	0.008±0.001	0.004±0.000	B, C	< 0.01 *	< 0.01 *
2-Methyl-2-butenoic acid	1827.69	55	0.004±0.00	0.014±0.001	0.016±0.000	0.013±0.001	0.015±0.002	A, B, C	< 0.01 *	0.428
Hexanoic acid (Caproic acid)	1829.06	60	0.016±0.00	0.012±0.000	0.013±0.001	0.010±0.002	0.012±0.001	B, C	0.193	0.153
2-Phenylethyl alcohol	1891.20	91	0.014±0.00	1.079±0.027	0.075±0.004	0.930±0.119	0.053±0.002	A, B, C	< 0.01 *	0.159
3-Hydroxy-2-methyl-4*H* -pyran-4-one (Maltol)	1938.84	126	0.013±0.00	0.272±0.006	0.281±0.014	0.255±0.017	0.294±0.016	A, B, C	0.434	0.274
2-Acetylpyrrole	1947.68	94	0.002±0.00	0.012±0.000	0.015±0.001	0.012±0.001	0.016±0.001	A, B, C	0.014 *	0.560
5-Ethyl-2(3*H*)-furanone	1952.29	83	0.004±0.00	0.017±0.001	0.002±0.000	0.017±0.001	0.002±0.000	B, C	< 0.01 *	0.600
(*R*)-Dihydro-3-hydroxy-4,4-dimethyl-2(3H)-furanone	2003.10	71	0.004±0.00	0.091±0.002	0.084±0.003	0.100±0.003	0.100±0.005	C	0.055	0.021
2,5-Dimethyl-4-hydroxy-3(2*H*)-furanone (HDMF)	2008.05	128	0.002±0.00	0.013±0.001	0.018±0.001	0.006±0.001	0.009±0.001	A, B, C	< 0.01 *	< 0.01 *
3,5-Dimethyl-4-heptanone	2039.48	57	0.002±0.00	0.408±0.006	0.014±0.001	0.403±0.058	0.008±0.000	C	< 0.01 *	0.910
5(or 2)-Ethyl-4-hydroxy-2(or 5)-methyl-3(2*H*)-furanone (HEMF)	2070.65	71	0.002±0.00	0.307±0.011	0.011±0.000	0.305±0.028	0.005±0.001	A, B	< 0.01 *	0.950

Compound name	RI[a]	Quantitative *m/z*	Relative peak height (mean ± SD)[b]					Reliability[d]	*p*-value[c]	
			0 week	18 weeks					Control vs. LAB + EtOH	Control vs. Acid + Yeast
				Control	LAB + EtOH	Acid + Yeast	Acid + EtOH			
4-Hydroxy-5-methyl-furanone	2088.91	114	0.002±0.00	0.122±0.011	0.320±0.010	0.091±0.012	0.303±0.038	A, B	< 0.01 *	0.055
Caprolactam	2144.00	55	0.010±0.00	0.075±0.015	0.077±0.006	0.092±0.028	0.081±0.005	A, C	0.912	0.507
2-Methoxy-4-vinylphenol (4-Vinylguaiacol)	2170.61	135	0.356±0.06	0.961±0.082	0.855±0.016	0.659±0.071	0.771±0.060	A, B, C	0.145	0.017
1,2,3-Benzenetriol (Pyrogallol)	2237.13	154	0.006±0.00	0.100±0.008	0.078±0.015	0.064±0.024	0.087±0.019	C	0.147	0.111
3,5-Dihydroxy-6-methyl-2,3-dihydro-4*H*-pyran-4-one	2240.95	101	0.002±0.00	0.029±0.002	0.054±0.002	0.044±0.041	0.048±0.009	C	< 0.01 *	0.666
Ethyl hexadecanoate (Ethyl Palmitate)	2249.03	88	0.002±0.00	0.151±0.012	0.117±0.009	0.184±0.006	0.115±0.011	C	0.031	0.023
2-Methoxy-6-methyl-4-pyran-4-one	2279.45	69	0.002±0.00	0.083±0.004	0.043±0.001	0.082±0.006	0.035±0.005	C	< 0.01 *	0.838
4-Oxopentanoic acid (Levulinic acid)	2296.21	56	0.002±0.00	0.018±0.002	0.025±0.001	0.025±0.002	0.030±0.002	A, C	0.012 *	0.021
mono-Ethyl succinate	2353.65	101	0.002±0.00	1.592±0.026	0.882±0.024	1.665±0.121	0.913±0.051	C	< 0.01 *	0.449
Benzoic acid	2422.49	105	0.002±0.00	0.002±0.000	0.002±0.000	0.002±0.000	0.002±0.001	C	0.484	0.875
Phenylacetic acid	2530.37	91	0.002±0.00	0.288±0.010	0.302±0.010	0.269±0.013	0.280±0.032	C	0.257	0.180
4-Ethyl-2,6-dimethoxyphenol	2541.07	180	0.005±0.00	0.143±0.013	0.173±0.008	0.126±0.001	0.163±0.014	A, C	0.051	0.215
n-Hexadecanoic acid (Palmitic acid)	2883.57	73	0.484±0.09	0.037±0.003	0.028±0.001	0.038±0.001	0.024±0.003	C	0.013 *	0.664
2-(4-Hydroxyphenyl)ethanol	2961.10	107	0.002±0.00	0.736±0.029	0.069±0.001	0.657±0.053	0.031±0.001	C	< 0.01 *	0.135
1,4-Benzenediol	2982.95	110	0.002±0.00	0.109±0.005	0.108±0.001	0.089±0.006	0.095±0.002	C	0.743	0.025
(*Z*,*Z*)-9,12-Octadecadienoic acid (Linoleic acid)	3177.31	81	0.154±0.03	0.002±0.000	0.002±0.000	0.003±0.001	0.003±0.000	C	0.263	0.436

a: Retention indices (RI) were determined using n-alkanes C11–C32

b: Relative intensity of compounds are displayed as mean ± standard deviation for three independent experiments. Control: control samples inoculated with *Zygosaccharomyces rouxii* and *Tetragenococcus halophilus*. LAB + EtOH: Samples inoculated with *T. halophllus* and added ethanol. Acid + Yeast: Samples added lactic acid and acetic acid and inoculated with *Z. rouxii*. Acid + EtOH: Sample added lactic acid, acetic acid and ethanol.

c: *p*-value are calcurated by AIoutout 2 software. Significant constituents were marked.

d: Reliability of volatile annotation was shown as follows: A, mass spectrum and retention index were consistent with those of an authentic compound; B, mass spectrum and retention index were consistent with those of the literature (12, 44-46); C, mass spectrum was consistent with that of the NIST11 MS spectral library.