

**Supplementary materials Table S1.** Volatiles (GC-MS Peak Area  $\times 10^6$ ) detected in the native *SSP* model under different heating conditions

No.	RT (min)	Substances	100 °C, 30 min	100 °C, 60 min	100 °C, 90 min	100 °C, 120 min	100 °C, 150 min
1	3.704	2-methylfural	1.88±0.10 <sup>Ed</sup>	9.75±0.22 <sup>Ca</sup>	7.33±0.13 <sup>Da</sup>	13.10±0.10 <sup>Ba</sup>	15.47±0.07 <sup>Aa</sup>
2	7.139	Hexanal	6.30±0.20 <sup>Aa</sup>	5.00±0.04 <sup>Bb</sup>	4.03±0.07 <sup>Cb</sup>	4.90±0.04 <sup>Cc</sup>	3.20±0.10 <sup>Dd</sup>
3	8.873	2-Heptanone	2.78±0.02 <sup>Ac</sup>	2.70±0.04 <sup>Ad</sup>	2.24±0.06 <sup>Dd</sup>	2.58±0.05 <sup>Be</sup>	2.34±0.06 <sup>Cc</sup>
4	8.906	Heptanal	ND	ND	ND	ND	ND
5	9.573	Pyrazine	0.06±0.001 <sup>Cf</sup>	0.10±0.01 <sup>Ba</sup>	0.11±0.01 <sup>Bh</sup>	0.18±0.01 <sup>Aj</sup>	0.18±0.02 <sup>Aa</sup>
6	9.857	2-pentylfural	3.58±0.08 <sup>De</sup>	4.65±0.13 <sup>Cc</sup>	3.57±0.05 <sup>Dc</sup>	5.31±0.04 <sup>Bb</sup>	7.95±0.02 <sup>Ai</sup>
7	10.915	2-methylpyrazine	0.18±0.03 <sup>Cc</sup>	0.57±0.04 <sup>BCf</sup>	0.78±0.03 <sup>Bf</sup>	1.26±0.04 <sup>Af</sup>	1.41±0.03 <sup>Af</sup>
8	12.874	2,5(6)-dimethylpyrazine	ND	0.10±0.02 <sup>Dh</sup>	0.22±0.02 <sup>Cg</sup>	0.42±0.01 <sup>Ah</sup>	0.37±0.02 <sup>Bh</sup>
9	13.074	2-ethylpyrazine	ND	ND	ND	ND	0.22±0.02 <sup>j</sup>
10	13.508	2,3-dimethylpyrazine	ND	ND	ND	ND	ND
11	14.933	Nonanal	0.33±0.03 <sup>Be</sup>	0.40±0.01 <sup>Ag</sup>	0.26±0.01 <sup>Cg</sup>	0.26±0.02 <sup>Ci</sup>	0.29±0.02 <sup>Ci</sup>
12	15.108	2-ethyl-5-methylpyrazine	ND	ND	ND	ND	ND
13	15.508	2, 3, 5-trimethylpyrazine	ND	ND	ND	ND	ND
14	15.517	2-ethyl-3-methylpyrazine	ND	ND	ND	ND	ND
15	16.834	3-ethyl-2,5-dimethylpyrazine	ND	ND	ND	ND	ND
16	17.284	Furfural	0.13±0.01 <sup>Ef</sup>	0.35±0.03 <sup>Cg</sup>	0.24±0.01 <sup>Dg</sup>	0.66±0.02 <sup>Bg</sup>	1.04±0.03 <sup>Ag</sup>
17	17.860	2-methyl-5-propylpyrazine	ND	ND	ND	ND	ND
18	18.343	3,5-diethyl-2-methylpyrazine	ND	ND	ND	ND	ND
19	22.936	2-Furanylmethanol	0.35±0.04 <sup>Ee</sup>	1.72±0.06 <sup>Ce</sup>	1.49±0.04 <sup>De</sup>	3.37±0.04 <sup>Bd</sup>	4.33±0.03 <sup>Ac</sup>
		Total pyrazines	0.24	0.77	1.11	1.86	2.18
		Pyrazines (% of total GC-MS peak area)	2.00	3.00	5.00	6.00	6.00

No.	RT (min)	Substances	110 °C, 30 min	110 °C, 60 min	110 °C, 90 min	110 °C, 120 min	110 °C, 150 min
1	3.704	2-methylfural	2.55±0.03 <sup>Ea</sup>	4.53±0.08 <sup>Da</sup>	5.59±0.03 <sup>Aa</sup>	5.07±0.04 <sup>Ca</sup>	5.19±0.04 <sup>Ba</sup>
2	7.139	Hexanal	2.52±0.02 <sup>Ab</sup>	2.36±0.02 <sup>Bc</sup>	1.84±0.03 <sup>Cd</sup>	1.34±0.02 <sup>Dd</sup>	1.26±0.03 <sup>Ed</sup>
3	8.873	2-Heptanone	1.47±0.05 <sup>Ad</sup>	1.05±0.04 <sup>Ae</sup>	1.03±0.02 <sup>Ae</sup>	1.02±0.03 <sup>Ae</sup>	1.02±0.01 <sup>Ae</sup>
4	8.906	Heptanal	ND	ND	ND	ND	ND
5	9.573	Pyrazine	0.02±0.01 <sup>Bh</sup>	0.05±0.01 <sup>Bi</sup>	0.07±0.01 <sup>Ai</sup>	0.07±0.02 <sup>Ai</sup>	0.07±0.03 <sup>Aa</sup>
6	9.857	2-pentylfural	2.37±0.02 <sup>Dc</sup>	3.54±0.03 <sup>Ch</sup>	4.01±0.03 <sup>Ah</sup>	3.71±0.05 <sup>Bh</sup>	3.71±0.03 <sup>Bi</sup>
7	10.915	2-methylpyrazine	0.09±0.02 <sup>Db</sup>	0.25±0.02 <sup>Cg</sup>	0.37±0.01 <sup>Bg</sup>	0.49±0.03 <sup>Agf</sup>	0.45±0.04 <sup>Ag</sup>
8	12.874	2,5(6)-dimethylpyrazine	ND	0.16±0.01 <sup>Bh</sup>	0.19±0.02 <sup>Bh</sup>	0.25±0.03 <sup>Ah</sup>	0.23±0.01 <sup>Ah</sup>
9	13.074	2-ethylpyrazine	ND	ND	ND	ND	0.06±0.01 <sup>j</sup>
10	13.508	2,3-dimethylpyrazine	ND	ND	ND	ND	ND
11	14.933	Nonanal	0.55±0.03 <sup>Bc</sup>	0.46±0.02 <sup>Cf</sup>	0.42±0.01 <sup>Cf</sup>	0.52±0.04 <sup>Bf</sup>	0.61±0.01 <sup>Af</sup>
12	15.108	2-ethyl-5-methylpyrazine	ND	ND	ND	ND	ND
13	15.508	2, 3, 5-trimethylpyrazine	ND	ND	ND	ND	ND
14	15.517	2-ethyl-3-methylpyrazine	ND	ND	ND	ND	ND
15	16.834	3-ethyl-2,5-dimethylpyrazine	ND	ND	ND	ND	ND
16	17.284	Furfural	0.07±0.01 <sup>Dg</sup>	0.07±0.02 <sup>Di</sup>	0.41±0.03 <sup>Cf</sup>	0.46±0.01 <sup>Bg</sup>	0.56±0.04 <sup>Ag</sup>
17	17.860	2-methyl-5-propylpyrazine	ND	ND	ND	ND	ND
18	18.343	3,5-diethyl-2-methylpyrazine	ND	ND	ND	ND	ND
19	22.936	2-Furanylmethanol	0.40±0.01 <sup>Ef</sup>	1.25±0.02 <sup>Dd</sup>	1.88±0.03 <sup>Cc</sup>	2.18±0.04 <sup>Bc</sup>	2.69±0.02 <sup>Ac</sup>
		Total pyrazines	0.11	0.46	0.63	0.81	0.81
		Pyrazines (%of total GC-MS peak area)	1.00	3.00	4.00	5.00	5.00

No.	RT (min)	Substances	120 °C, 30 min	120 °C, 60 min	120 °C, 90 min	120 °C, 120 min	120 °C, 150 min
1	3.704	2-methylfural	8.28±0.05 <sup>Db</sup>	10.58±0.04 <sup>Cb</sup>	11.38±0.12 <sup>Bb</sup>	8.25±0.04 <sup>Da</sup>	12.65±0.05 <sup>Ab</sup>
2	7.139	Hexanal	3.47±0.02 <sup>Ad</sup>	2.80±0.03 <sup>Bd</sup>	2.41±0.03 <sup>Ce</sup>	2.35±0.05 <sup>Dd</sup>	2.25±0.02 <sup>Ee</sup>
3	8.873	2-Heptanone	1.72±0.03 <sup>Ae</sup>	1.45±0.04 <sup>CDg</sup>	1.50±0.02 <sup>Cg</sup>	1.64±0.03 <sup>Be</sup>	1.40±0.02 <sup>Df</sup>
4	8.906	Heptanal	ND	ND	ND	8.13±0.02 <sup>a</sup>	ND
5	9.573	Pyrazine	ND	ND	ND	ND	ND
6	9.857	2-pentylfural	8.75±0.04 <sup>Da</sup>	11.97±0.02 <sup>Ca</sup>	12.35±0.04 <sup>Ba</sup>	8.13±0.13 <sup>Eb</sup>	13.18±0.15 <sup>Aa</sup>
7	10.915	2-methylpyrazine	0.60±0.01 <sup>Dh</sup>	0.94±0.02 <sup>Ch</sup>	1.01±0.04 <sup>Bh</sup>	1.42±0.06 <sup>Af</sup>	0.90±0.02 <sup>Cg</sup>
8	12.874	2,5(6)-dimethylpyrazine	0.17±0.02 <sup>Ei</sup>	0.28±0.01 <sup>Di</sup>	0.43±0.02 <sup>Ci</sup>	0.69±0.02 <sup>Bg</sup>	0.85±0.03 <sup>Ag</sup>
9	13.074	2-ethylpyrazine	ND	ND	ND	ND	ND
10	13.508	2,3-dimethylpyrazine	ND	ND	ND	ND	ND
11	14.933	Nonanal	1.40±0.03 <sup>Cf</sup>	2.49±0.14 <sup>Be</sup>	2.52±0.12 <sup>Bd</sup>	2.53±0.08 <sup>Bc</sup>	5.27±0.08 <sup>Ad</sup>
12	15.108	2-ethyl-5-methylpyrazine	ND	0.10±0.02 <sup>Cj</sup>	0.17±0.03 <sup>Bj</sup>	0.19±0.01 <sup>Bi</sup>	0.38±0.05 <sup>Ah</sup>
13	15.508	2, 3, 5-trimethylpyrazine	ND	ND	ND	ND	ND
14	15.517	2-ethyl-3-methylpyrazine	ND	ND	ND	ND	ND
15	16.834	3-ethyl-2,5-dimethylpyrazine	ND	ND	ND	ND	ND
16	17.284	Furfural	1.08±0.03 <sup>Dg</sup>	1.65±0.04 <sup>Af</sup>	1.73±0.03 <sup>Af</sup>	1.49±0.07 <sup>Bf</sup>	1.39±0.06 <sup>Cf</sup>
17	17.860	2-methyl-5-propylpyrazine	ND	ND	ND	ND	ND
18	18.343	3,5-diethyl-2-methylpyrazine	ND	ND	ND	ND	ND
19	22.936	2-Furanylmethanol	3.95±0.04 <sup>Dc</sup>	8.02±0.06 <sup>Cc</sup>	9.03±0.19 <sup>Bc</sup>	0.48±0.03 <sup>Eh</sup>	9.70±0.50 <sup>Ac</sup>
		Total pyrazines	0.77	1.32	1.61	2.30	2.13
		Pyrazines (% of total GC-MS peak area)	2.60	3.30	3.80	6.50	4.40

No.	RT (min)	Substances	130 °C, 30 min	130 °C, 60 min	130 °C, 90 min	130 °C, 120 min	130 °C, 150 min
1	3.704	2-methylfural	3.02±0.18 <sup>Ea</sup>	4.08±0.06 <sup>Da</sup>	4.53±0.02 <sup>Ca</sup>	6.08±0.10 <sup>Ba</sup>	5.58±0.12 <sup>Aa</sup>
2	7.139	Hexanal	1.21±0.12 <sup>Ac</sup>	0.91±0.03 <sup>Bd</sup>	0.92±0.03 <sup>Be</sup>	0.97±0.02 <sup>Be</sup>	1.11±0.02 <sup>Ac</sup>
3	8.873	2-Heptanone	0.51±0.05 <sup>Bde</sup>	0.41±0.05 <sup>Ce</sup>	0.50±0.02 <sup>Bf</sup>	0.42±0.01 <sup>Cf</sup>	0.71±0.02 <sup>Af</sup>
4	8.906	Heptanal	ND	ND	ND	ND	ND
5	9.573	Pyrazine	0.04±0.01 <sup>De</sup>	0.07±0.01 <sup>Cgh</sup>	0.08±0.01 <sup>Ch</sup>	0.98±0.02 <sup>Ad</sup>	0.11±0.01 <sup>Bab</sup>
6	9.857	2-pentylfural	2.50±1.19 <sup>Db</sup>	4.01±0.03 <sup>Ca</sup>	4.04±0.05 <sup>Cb</sup>	5.00±0.40 <sup>Bb</sup>	5.50±0.40 <sup>Ah</sup>
7	10.915	2-methylpyrazine	0.19±0.02 <sup>Bde</sup>	0.21±0.02 <sup>Bf</sup>	0.28±0.03 <sup>Ag</sup>	0.30±0.02 <sup>Afg</sup>	0.30±0.01 <sup>Agh</sup>
8	12.874	2,5(6)-dimethylpyrazine	0.07±0.01 <sup>De</sup>	0.16±0.04 <sup>Cfg</sup>	0.32±0.01 <sup>Bg</sup>	0.39±0.03 <sup>Af</sup>	0.43±0.01 <sup>Ag</sup>
9	13.074	2-ethylpyrazine	0.02±0.01 <sup>Be</sup>	0.04±0.01 <sup>ABgh</sup>	0.06±0.01 <sup>Ahi</sup>	0.05±0.02 <sup>Agh</sup>	0.05±0.01 <sup>Ai</sup>
10	13.508	2,3-dimethylpyrazine	ND	ND	ND	ND	ND
11	14.933	Nonanal	0.68±0.06 <sup>Cd</sup>	1.56±0.16 <sup>Bc</sup>	1.58±0.15 <sup>Bd</sup>	3.07±0.02 <sup>Ad</sup>	3.06±0.03 <sup>Ad</sup>
12	15.108	2-ethyl-5-methylpyrazine	ND	ND	0.13±0.02 <sup>Ah</sup>	0.12±0.03 <sup>Agh</sup>	0.12±0.01 <sup>Ahi</sup>
13	15.508	2, 3, 5-trimethylpyrazine	ND	ND	ND	ND	ND
14	15.517	2-ethyl-3-methylpyrazine	ND	ND	ND	ND	ND
15	16.834	3-ethyl-2,5-dimethylpyrazine	ND	ND	ND	ND	ND
16	17.284	Furfural	0.54±0.02 <sup>Ade</sup>	0.51±0.08 <sup>Ae</sup>	0.52±0.06 <sup>Af</sup>	0.46±0.04 <sup>Af</sup>	0.52±0.02 <sup>Afg</sup>
17	17.860	2-methyl-5-propylpyrazine	ND	ND	ND	ND	ND
18	18.343	3,5-diethyl-2-methylpyrazine	ND	ND	ND	ND	ND
19	22.936	2-Furanylmethanol	2.08±0.08 <sup>Bb</sup>	2.07±0.22 <sup>Bb</sup>	2.06±0.03 <sup>Bc</sup>	3.71±0.51 <sup>Ac</sup>	3.60±0.40 <sup>Ac</sup>
		Total pyrazines	0.32	0.48	0.87	1.84	1.01
		Pyrazines (% of total GC-MS peak area)	2.90	3.40	5.80	8.50	4.80

No.	RT (min)	Substances	140 °C, 30 min	140 °C, 60 min	140 °C, 90 min	140 °C, 120 min	140 °C, 150 min
1	3.704	2-methylfural	8.69±0.69 <sup>Ca</sup>	10.85±0.2 <sup>Ba</sup>	2.01±0.11 <sup>Db</sup>	2.97±0.06 <sup>Da</sup>	13.01±1.00 <sup>Aa</sup>
2	7.139	Hexanal	3.21±0.21 <sup>Ae</sup>	2.88±0.08 <sup>Be</sup>	ND	ND	1.43±0.06 <sup>Cg</sup>
3	8.873	2-Heptanone	ND	ND	0.43±0.02 <sup>ABd</sup>	0.08±0.02 <sup>Bfg</sup>	1.01±0.55 <sup>Ahij</sup>
4	8.906	Heptanal	ND	ND	ND	ND	ND
5	9.573	Pyrazine	0.37±0.05 <sup>Aabc</sup>	0.41±0.02 <sup>Ab</sup>	0.07±0.01 <sup>Cef</sup>	0.09±0.02 <sup>Cfg</sup>	0.12±0.01 <sup>Bjk</sup>
6	9.857	2-pentylfural	7.65±0.68 <sup>Bb</sup>	6.54±0.30 <sup>Cc</sup>	2.64±0.64 <sup>Df</sup>	2.08±0.07 <sup>Dc</sup>	10.11±0.11 <sup>Ab</sup>
7	10.915	2-methylpyrazine	0.60±0.02 <sup>Ag</sup>	0.68±0.04 <sup>Ag</sup>	0.07±0.02 <sup>Bef</sup>	0.08±0.01 <sup>Bfg</sup>	0.45±0.08 <sup>Ahij</sup>
8	12.874	2,5(6)-dimethylpyrazine	0.47±0.05 <sup>Cgh</sup>	1.10±0.10 <sup>Ad</sup>	0.31±0.03 <sup>Cce</sup>	0.29±0.03 <sup>Ce</sup>	0.64±0.04 <sup>Bf</sup>
9	13.074	2-ethylpyrazine	0.18±0.06 <sup>Aghi</sup>	0.21±0.02 <sup>Ai</sup>	0.03±0.001 <sup>Bf</sup>	0.01±0.001 <sup>Bg</sup>	0.20±0.02 <sup>Ajk</sup>
10	13.508	2,3-dimethylpyrazine	ND	ND	ND	ND	ND
11	14.933	Nonanal	4.27±0.27 <sup>Cd</sup>	7.02±0.04 <sup>Ah</sup>	1.77±0.12 <sup>Ebc</sup>	2.16±0.16 <sup>Db</sup>	6.25±0.05 <sup>Bd</sup>
12	15.108	2-ethyl-5-methylpyrazine	0.12±0.01 <sup>Dhi</sup>	0.54±0.02 <sup>Bgh</sup>	0.07±0.002 <sup>Eef</sup>	0.15±0.02 <sup>Cf</sup>	0.62±0.01 <sup>Agh</sup>
13	15.508	2, 3, 5-trimethylpyrazine	ND	ND	ND	ND	0.61±0.05 <sup>hi</sup>
14	15.517	2-ethyl-3-methylpyrazine	ND	ND	0.03±0.002 <sup>f</sup>	ND	ND
15	16.834	3-ethyl-2,5-dimethylpyrazine	ND	0.98±0.02 <sup>Af</sup>	ND	0.15±0.01 <sup>Cf</sup>	0.87±0.03 <sup>Be</sup>
16	17.284	Furfural	1.36±0.10 <sup>Af</sup>	1.13±0.12 <sup>Bf</sup>	0.38±0.02 <sup>Cd</sup>	0.26±0.04 <sup>Ce</sup>	ND
17	17.860	2-methyl-5-propylpyrazine	ND	ND	ND	ND	0.13±0.01 <sup>ijk</sup>
18	18.343	3,5-diethyl-2-methylpyrazine	ND	ND	ND	ND	0.12±0.04 <sup>ijk</sup>
19	22.936	2-Furanylmethanol	6.00±0.08 <sup>Bc</sup>	6.01±0.06 <sup>Bd</sup>	1.61±0.04 <sup>Cc</sup>	1.54±0.05 <sup>Cd</sup>	7.71±0.03 <sup>Ac</sup>
		Total pyrazines	1.74	3.92	0.55	0.77	3.76
		Pyrazines (% of total GC-MS peak area)	5.00	10.00	6.00	8.00	9.00

Numbers are represented as the means ± standard deviations.

Mean values with different superscript capital letters in the same row have significant differences ( $p < 0.05$ ).

Mean values with different superscript small letters in the same column have significant differences at the same temperature ( $p < 0.05$ ).