

Supplementary materials Table S3. Volatiles (GC-MS Peak Area $\times 10^6$) detected in the hydrolyzed *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	2.96±0.002 ^{Dc}	6.00±0.12 ^{Cb}	8.58±0.01 ^{Ba}	16.74±0.06 ^{Ak}	16.63±0.04 ^{Aa}
2	7.139	Hexanal	4.05±0.05 ^{Ab}	3.65±0.002 ^{Bc}	3.49±0.02 ^{Cc}	2.21±0.09 ^{De}	1.55±0.03 ^{Eg}
3	8.873	2-Heptanone	2.52±0.01 ^{Cd}	3.27±0.03 ^{Bd}	3.41±0.01 ^{Ad}	2.48±0.01 ^{Cf}	2.33±0.07 ^{Df}
4	8.906	Heptanal	ND	ND	ND	ND	ND
5	9.573	Pyrazine	0.18±0.01 ^{Dh}	0.10±0.01 ^{Ei}	0.29±0.01 ^{Ci}	0.35±0.01 ^{Bb}	0.39±0.01 ^{Aj}
6	9.857	2-pentylfural	6.96±0.04 ^{Da}	8.85±0.01 ^{Ba}	6.91±0.06 ^{Db}	9.20±0.04 ^{Aj}	7.13±0.07 ^{Cb}
7	10.915	2-methylpyrazine	1.36±0.02 ^{De}	3.04±0.06 ^{Be}	2.91±0.02 ^{Cc}	3.02±0.03 ^{Bh}	6.76±0.04 ^{Ac}
8	12.874	2,5(6)-dimethylpyrazine	ND	0.57±0.01 ^{Ch}	1.02±0.08 ^{Bg}	2.66±0.02 ^{Ag}	2.68±0.05 ^{Ae}
9	13.074	2-ethylpyrazine	ND	ND	0.09±0.005 ^{Cj}	0.35±0.001 ^{Ab}	0.34±0.002 ^{Bk}
10	13.508	2,3-dimethylpyrazine	ND	ND	ND	ND	0.10±0.01 ^I
11	14.933	Nonanal	0.42±0.002 ^{Eg}	0.68±0.01 ^{Bg}	0.44±0.002 ^{Dh}	0.81±0.01 ^{Ad}	0.58±0.01 ^{Ci}
12	15.108	2-ethyl-5-methylpyrazine	ND	ND	ND	0.30±0.002 ^{Aa}	0.30±0.01 ^{Ak}
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	ND	0.13±0.001 ^{Ci}	1.05±0.05 ^{Ag}	0.63±0.02 ^{Bc}	0.64±0.01 ^{Bh}
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	0.51±0.02 ^{Ef}	0.86±0.01 ^{Df}	1.34±0.02 ^{Cf}	3.43±0.01 ^{Bi}	3.71±0.01 ^{Ad}
		Total pyrazines	1.54	3.84	5.36	7.31	11.21
		Pyrazines (% of total GC-MS peak area)	8.12	14.14	18.15	17.33	25.99

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	2.26±0.03 ^{Eb}	4.41±0.01 ^{Da}	5.18±0.02 ^{Ba}	5.07±0.03 ^{Ca}	5.82±0.02 ^{Aa}
2	7.139	Hexanal	1.90±0.01 ^{Ac}	1.09±0.02 ^{Cd}	1.16±0.01 ^{Be}	0.84±0.002 ^{Df}	0.68±0.01 ^{Ef}
3	8.873	2-Heptanone	1.08±0.02 ^{Ad}	0.81±0.01 ^{Bf}	0.74±0.01 ^{Cg}	0.68±0.02 ^{Dg}	0.58±0.03 ^{Efg}
4	8.906	Heptanal	ND	ND	ND	ND	ND
5	9.573	Pyrazine	0.07±0.01 ^{Db}	0.15±0.002 ^{Bi}	0.15±0.001 ^{Bj}	0.13±0.01 ^{Cb}	0.17±0.01 ^{Aij}
6	9.857	2-pentylfural	2.66±0.01 ^{Ca}	3.54±0.02 ^{ABb}	3.71±0.05 ^{ABb}	3.97±0.03 ^{Ab}	2.97±0.59 ^{Bb}
7	10.915	2-methylpyrazine	0.63±0.01 ^{De}	1.07±0.03 ^{Cd}	1.56±0.04 ^{Ad}	1.28±0.02 ^{Bd}	1.54±0.01 ^{Ad}
8	12.874	2,5(6)-dimethylpyrazine	0.14±0.001 ^{Dh}	0.90±0.01 ^{Ce}	1.02±0.02 ^{Bf}	0.90±0.01 ^{Ce}	1.23±0.02 ^{Ae}
9	13.074	2-ethylpyrazine	ND	0.11±0.01 ^{Cj}	0.16±0.01 ^{Bj}	0.11±0.002 ^{Cj}	0.31±0.004 ^{Ahi}
10	13.508	2,3-dimethylpyrazine	ND	ND	0.06±0.001 ^{Ak}	0.04±0.002 ^{Ck}	0.05±0.001 ^{Bj}
11	14.933	Nonanal	0.25±0.002 ^{Eg}	0.39±0.001 ^{Dg}	0.54±0.02 ^{Ch}	0.63±0.01 ^{Bh}	0.79±0.01 ^{Af}
12	15.108	2-ethyl-5-methylpyrazine	ND	0.06±0.001 ^{Bk}	0.06±0.002 ^{Bk}	0.06±0.01 ^{Bk}	0.14±0.01 ^{Aij}
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	0.05±0.002 ^{Ei}	0.23±0.001 ^{Dh}	0.33±0.002 ^{Ci}	0.39±0.03 ^{Bi}	0.44±0.02 ^{Agh}
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±0.01 ^{Ef}	1.39±0.01 ^{Dc}	2.04±0.04 ^{Cc}	2.19±0.03 ^{Bc}	2.74±0.01 ^{Ac}
		Total pyrazines	0.89	2.52	3.34	2.91	3.88
		Pyrazines (% of total GC-MS peak area)	9.48	17.81	20.00	17.86	22.22

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	9.32±0.08 ^{Da}	13.64±0.06 ^{Ca}	15.19±0.19 ^{Ba}	15.23±0.17 ^{Ba}	37.56±0.44 ^{Aa}
2	7.139	Hexanal	2.35±0.01 ^{Bd}	2.18±0.03 ^{Cf}	1.37±0.01 ^{Dg}	1.14±0.02 ^{Eg}	2.63±0.02 ^{Ag}
3	8.873	2-Heptanone	1.33±0.02 ^{Cf}	1.79±0.01 ^{Bh}	0.84±0.01 ^{Dc}	0.86±0.004 ^{Di}	1.90±0.003 ^{Ah}
4	8.906	Heptanal	ND	ND	ND	ND	ND
5	9.573	Pyrazine	0.42±0.002 ^{Dh}	0.47±0.005 ^{Ck}	0.48±0.001 ^{Bj}	0.47±0.002 ^{Cl}	0.56±0.003 ^{Ajk}
6	9.857	2-pentylfural	8.40±0.16 ^{Db}	10.28±0.08 ^{Bb}	11.01±0.09 ^{Ab}	8.76±0.04 ^{Cb}	11.14±0.04 ^{Ac}
7	10.915	2-methylpyrazine	4.15±0.02 ^{Ec}	5.00±0.06 ^{Cd}	4.78±0.02 ^{Dd}	5.38±0.05 ^{Bd}	5.84±0.06 ^{Ad}
8	12.874	2,5(6)-dimethylpyrazine	2.08±0.02 ^{Ee}	3.06±0.06 ^{De}	3.30±0.1 ^{Bf}	4.49±0.01 ^{Ce}	4.15±0.08 ^{Ae}
9	13.074	2-ethylpyrazine	0.39±0.01 ^{Eh}	0.63±0.02 ^{Dj}	0.74±0.01 ^{Ci}	1.15±0.02 ^{Ag}	1.09±0.01 ^{Bi}
10	13.508	2,3-dimethylpyrazine	ND	0.26±0.01 ^{Bm}	0.16±0.003 ^{Ck}	0.38±0.004 ^{Am}	0.26±0.02 ^{Bkl}
11	14.933	Nonanal	1.47±0.03 ^{Df}	2.11±0.01 ^{Cg}	3.23±0.27 ^{Ae}	2.78±0.02 ^{Bf}	3.82±0.60 ^{Af}
12	15.108	2-ethyl-5-methylpyrazine	0.16±0.01 ^{Ei}	0.37±0.01 ^{Di}	0.59±0.01 ^{Cj}	0.75±0.004 ^{Bj}	0.94±0.01 ^{Ai}
13	15.508	2, 3, 5-trimethylpyrazine	ND	ND	ND	ND	0.17±0.002 ^l
14	15.517	2-ethyl-3-methylpyrazine	ND	0.19±0.02 ^{Cn}	0.52±0.002 ^{Bb}	0.57±0.01 ^{Ak}	0.59±0.04 ^{Aj}
15	16.834	3-ethyl-2,5-dimethylpyrazine	ND	ND	ND	ND	ND
16	17.284	Furfural	0.84±0.06 ^{Dg}	1.03±0.03 ^{Bci}	1.14±0.06 ^{Ah}	1.05±0.05 ^{Bh}	0.96±0.02 ^{Ci}
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	4.27±0.38 ^{Dc}	6.09±0.03 ^{Cc}	8.49±0.07 ^{Bc}	8.68±0.02 ^{Bc}	12.99±0.27 ^{Ab}
		Total pyrazines	8.04	11.01	11.71	14.24	14.56
		Pyrazines (% of total GC-MS peak area)	22.85	23.38	22.59	27.55	17.21

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	4.08±0.04 ^{Ca}	3.51±0.09 ^{Da}	3.05±0.05 ^{Ea}	5.47±0.03 ^{Aa}	5.16±0.04 ^{Bb}
2	7.139	Hexanal	0.97±0.02 ^{Ae}	0.67±0.01 ^{Be}	0.52±0.003 ^{Ef}	0.63±0.02 ^{Cg}	0.59±0.01 ^{Dg}
3	8.873	2-Heptanone	0.62±0.003 ^{Af}	0.31±0.02 ^{Dg}	0.33±0.01 ^{Dc}	0.36±0.002 ^{Ch}	0.39±0.01 ^{Bh}
4	8.906	Heptanal	ND	ND	ND	ND	ND
5	9.573	Pyrazine	0.19±0.002 ^{Ag}	0.1±0.01 ^{Dh}	0.11±0.003 ^{CDa}	0.12±0.008 ^{Cl}	0.16±0.01 ^{Bk}
6	9.857	2-pentylfural	3.03±0.18 ^{Db}	3.24±0.02 ^{Ca}	1.98±0.005 ^{Eb}	3.82±0.02 ^{Bb}	5.41±0.01 ^{Aa}
7	10.915	2-methylpyrazine	1.59±0.01 ^{Ad}	0.87±0.01 ^{Ed}	0.94±0.01 ^{Dd}	1.01±0.01 ^{Cf}	1.51±0.03 ^{Bf}
8	12.874	2,5(6)-dimethylpyrazine	0.92±0.03 ^{Ce}	0.85±0.01 ^{Dd}	0.79±0.02 ^{Ee}	1.34±0.01 ^{Be}	2.03±0.03 ^{Ae}
9	13.074	2-ethylpyrazine	0.15±0.002 ^{Cg}	0.11±0.001 ^{Dh}	0.15±0.003 ^{Ch}	0.17±0.002 ^{Bk}	0.28±0.001 ^{Aj}
10	13.508	2,3-dimethylpyrazine	0.13±0.001 ^{Dg}	0.04±0.001 ^{Ei}	0.15±0.002 ^{Ch}	0.17±0.01 ^{Bk}	0.28±0.01 ^{Aj}
11	14.933	Nonanal	0.61±0.01 ^{Ef}	1.46±0.01 ^{Cc}	0.94±0.002 ^{Dd}	2.06±0.04 ^{Bd}	2.60±0.03 ^{Ad}
12	15.108	2-ethyl-5-methylpyrazine	0.08±0.42 ^{Ag}	0.11±0.01 ^{Bh}	0.11±0.002 ^{Bi}	0.25±0.01 ^{ABj}	0.34±0.02 ^{ABi}
13	15.508	2, 3, 5-trimethylpyrazine	ND	ND	ND	ND	0.29±0.02 ^j
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	0.45±0.002 ^{Af}	0.43±0.001 ^{Bf}	0.32±0.01 ^{Cg}	0.32±0.01 ^{Ci}	0.28±0.01 ^{Dj}
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	1.89±0.01 ^{Cc}	2.09±0.11 ^{Bb}	1.58±0.02 ^{Dh}	3.42±0.08 ^{Ac}	3.45±0.05 ^{Ac}
		Total pyrazines	3.51	2.51	2.57	3.38	5.17
		Pyrazines (% of total GC-MS peak area)	23.86	18.20	23.43	17.66	22.71

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	10.40±0.05 ^{Ca}	10.08±0.02 ^{Da}	6.77±0.03 ^{Eb}	18.47±0.03 ^{Ba}	18.97±0.03 ^{Aa}
2	7.139	Hexanal	1.47±0.03 ^{Ag}	1.22±0.01 ^{Cd}	1.28±0.08 ^{BCj}	1.53±0.02 ^{Ah}	1.32±0.04 ^{Bh}
3	8.873	2-Heptanone	0.34±0.02 ^{Dj}	0.70±0.005 ^{Bd}	0.60±0.05 ^{Al}	0.52±0.01 ^{Ck}	0.83±0.03 ^{Ci}
4	8.906	Heptanal	ND	ND	ND	ND	ND
5	9.573	Pyrazine	0.39±0.01 ^{Bj}	0.34±0.01 ^{Cd}	0.42±0.02 ^{An}	0.29±0.01 ^{DI}	0.37±0.01 ^{Bk}
6	9.857	2-pentylfural	8.70±0.10 ^{Db}	9.25±3.51 ^{Cb}	5.10±0.10 ^{Ec}	15.43±0.03 ^{Ab}	14.32±0.32 ^{Bb}
7	10.915	2-methylpyrazine	4.05±0.05 ^{Cd}	4.07±0.03 ^{Cc}	4.24±0.06 ^{Dd}	1.63±0.06 ^{Ag}	2.44±0.06 ^{Bf}
8	12.874	2,5(6)-dimethylpyrazine	2.29±0.01 ^{Ae}	3.17±0.03 ^{Cc}	2.99±0.01 ^{Bf}	3.23±0.07 ^{Ce}	3.63±0.02 ^{De}
9	13.074	2-ethylpyrazine	0.78±0.02 ^{Dd}	0.60±0.002 ^{Bd}	0.67±0.01 ^{Cfg}	0.57±0.004 ^{Ak}	0.58±0.01 ^{Aj}
10	13.508	2,3-dimethylpyrazine	0.26±0.01 ^{Ck}	0.23±0.01 ^{Bd}	0.17±0.01 ^{Ao}	0.17±0.01 ^{Am}	0.22±0.02 ^{Cl}
11	14.933	Nonanal	1.64±0.06 ^{Af}	4.34±0.34 ^{Bc}	6.89±0.01 ^{Ca}	12.38±0.02 ^{Ec}	8.96±0.04 ^{Dc}
12	15.108	2-ethyl-5-methylpyrazine	0.54±0.004 ^{Ci}	0.70±0.10 ^{Bd}	0.72±0.01 ^{Bg}	0.88±0.01 ^{Ai}	0.81±0.01 ^{Ai}
13	15.508	2, 3, 5-trimethylpyrazine	ND	0.72±0.002 ^{Bd}	0.62±0.001 ^{Ckl}	0.72±0.004 ^{Bj}	0.84±0.01 ^{Ai}
14	15.517	2-ethyl-3-methylpyrazine	0.54±0.002 ^{Ai}	ND	0.51±0.03 ^{Bm}	ND	ND
15	16.834	3-ethyl-2,5-dimethylpyrazine	ND	1.29±0.01 ^{Cd}	1.04±0.06 ^{Dh}	1.79±0.09 ^{Bf}	2.24±0.06 ^{Ag}
16	17.284	Furfural	0.78±0.01 ^{Ch}	0.60±0.02 ^{Dd}	0.80±0.01 ^{Ci}	0.92±0.01 ^{Ai}	0.83±0.02 ^{Bi}
17	17.860	2-methyl-5-propylpyrazine	ND	0.08±0.01 ^{Cd}	0.08±0.001 ^{Cp}	0.15±0.002 ^{Am}	0.14±0.001 ^{Bl}
18	18.343	3,5-diethyl-2-methylpyrazine	ND	0.25±0.002 ^{Dd}	0.44±0.004 ^{Cn}	0.91±0.01 ^{Ai}	0.72±0.02 ^{Bi}
19	22.936	2-Furanylmethanol	5.31±0.09 ^{Cc}	4.30±0.10 ^{Db}	4.17±0.03 ^{De}	6.51±0.09 ^{Ad}	6.24±0.06 ^{Bd}
		Total pyrazines	9.63	12.05	12.7	11.26	12.82
		Pyrazines (% of total GC-MS peak area)	25.69	28.73	33.86	17.03	20.20

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 ($p < 0.05$).