Phenomenology of Neapolitan pizza baking in a traditional wood-fired oven

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Table S1 – Effect of baking time (t_B) on the average value and standard deviation of the instantaneous height (h) of the rim of different pizza samples (see types A-D in Table 1) during their baking in a pilot-scale wood-fired oven.

Rim height (h) of pizza sample [cm] t_B **[s]**	**A**	**B**	**C**	**D**
0	0.68±0.11 [a]	0.85±0.14 [b]	0.74±0.20 [a]	0.87±0.17 [b]
2	0.78±0.14 [a]	0.94±0.16 [b]	0.82±0.18 [a]	0.96±0.16 [b]
4	0.84±0.18 [a]	1.01±0.19 [b]	0.88±0.17 [a]	1.01±0.16 [b]
6	0.91±0.18 [a]	1.07±0.20 [b]	0.93±0.19 [a]	1.08±0.20 [b]
8	0.98±0.21 [a]	1.12±0.21 [b]	0.99±0.20 [a]	1.19±0.23 [b]
10	1.04±0.21 [a]	1.18±0.22 [a,b]	1.09±0.22 [a]	1.23±0.24 [b]
12	1.11±0.22 [a]	1.37±0.22 [b]	1.20±0.25 [a]	1.34±0.23 [b]
14	1.21±0.26 [a]	1.47±0.22 [b]	1.31±0.22 [a]	1.51±0.28 [b]
16	1.34±0.23 [a]	1.55±0.25 [b]	1.48±0.21 [a]	1.68±0.35 [b]
18	1.40±0.28 [a]	1.72±0.33 [b]	1.57±0.22 [a]	1.87±0.42 [b]
20	1.47±0.33 [a]	1.82±0.37 [b]	1.62±0.21 [a]	1.98±0.43 [b]
24	1.54±0.34 [a]	1.92±0.41 [b]	1.71±0.24 [a]	2.11±0.47 [b]
28	1.59±0.37 [a]	2.10±0.47 [b]	1.83±0.28 [a]	2.17±0.47 [b]
32	1.63±0.39 [a]	2.21±0.45 [b]	1.88±0.29 [a]	2.24±0.47 [b]
36	1.69±0.42 [a]	2.26±0.42 [b]	1.92±0.31 [a]	2.32±0.49 [b]
40	1.75±0.45 [a]	2.32±0.42 [b]	1.97±0.33 [a]	2.40±0.50 [b]
50	1.81±0.49 [a]	2.39±0.38 [b]	2.04±0.35 [a]	2.47±0.50 [b]
60	1.88±0.52 [a]	2.47±0.36 [b]	2.08±0.36 [a]	2.53±0.50 [b]
70	1.93±0.50 [a]	2.58±0.34 [b]	2.12±0.35 [a]	2.58±0.45 [b]
80	1.96±0.50 [a]	2.61±0.33 [b]	2.14±0.35 [a]	2.63±0.45 [b]

In each row, values with the same letter have no significant difference at $p < 0.05$.

Table S2: Main results (mean ± sd) of 12 repeated baking tests performed in a wood-fired pizza oven fed with 3 kg/h of oak logs using five pizza types A- E (see Table 1): effect of baking time (t_B) on the instantaneous temperature of the oven floor exposed to fire (T_{FL}) or shielded by the pizza sample (T_{FLbp}), temperatures of the pizza rim (T_{SR}), upper (T_{SU}) and lower (T_{SL}) areas, overall mass of sample (m_S), and estimated moisture fraction on oil-free basis (x_W). When 2 o 3 ingredients were added, T_{SU} was expressed by averaging the temperatures of the areas covered with tomato puree (TP), sunflower oil (SO) and/or mozzarella cheese (MC).

t_B	T_{FL}	T_{FLbp}	T_{SR}	T_{SU}			T_{SL}	m_S	x_W
[s]	[°C]	[°C]	[°C]	[°C]			[°C]	[g]	[g/g]
White pizza									
0	442 ± 9 [a]	442 ± 9 [a]	21.0±0.1 [a]	21.0±0.1 [a]			21.0±0.1 [a]	250.0±1.0 [a]	0.450
20	441 ± 7 [a]	363 ±10 [b]	80.0±3.0 [b]	103.0±2.0 [b]			84.0±2.0 [b]	248.2±0.2 [b]	0.446
40	436 ±11 [a]	348 ± 5 [b]	116.0±3.0 [c]	138.0±7.0 [c]			97.0±2.0 [c]	245.9±0.6 [c]	0.440
60	435 ± 7 [a]	332 ± 7 [c]	130.0±6.0 [d]	157.0±6.0 [d]			102.0±2.0 [d]	243.0±1.0 [d]	0.434
80	432 ±10 [a]	325 ± 5 [c]	148.0±9.0 [e]	182.0±9.0 [e]			106.0±3.0 [d]	240.6±0.7 [e]	0.428
White pizza garnished with sunflower oil									
0	446 ± 5 [a]	448 ± 7 [a]	21.0±0.1 [a]	21.0±0.1 [a]			21.0±0.1 [a]	280.0±2.0 [a]	0.450
20	443 ± 6 [a]	351 ±11 [b]	86.0±3.0 [b]	100.0±3.0 [b]			81.0±2.0 [b]	278.4±0.2 [a]	0.446
40	441 ± 7 [a]	342 ± 9 [b]	116.0±7.0 [c]	128.0±6.0 [c]			93.0±5.0 [c]	276.7±0.6 [b]	0.442
60	439 ±11 [a]	327 ± 7 [c]	149.0±7.0 [d]	148.0±5.0 [d]			101.0±3.0 [d]	272.4±1.3 [c]	0.432
80	434 ± 8 [a]	314 ± 7 [b,c]	169.0±9.0 [e]	156.0±4.0 [d]			105.0±2.0 [d]	267.7±1.6 [d]	0.421
Tomato pizza									
0	443 ± 8 [a]	440 ± 7 [a]	21.0±0.1 [a]	21.0±0.1 [a]			21.0±0.1 [a]	320.0±2.0 [a]	0.555
20	442 ± 7 [a]	339 ±10 [b]	83.0±2.0 [b]	59.0±2.0 [b]			75.0±2.0 [b]	319.1±0.3 [a]	0.553
40	439 ± 7 [a]	328 ± 6 [b]	113.0±4.0 [c]	71.0±2.0 [c]			92.0±3.0 [c]	317.1±0.5 [b]	0.551
60	438 ± 8 [a]	320 ±10 [b,c]	124.0±3.0 [d]	76.0±2.0 [d]			96.0±2.0 [c]	314.1±0.3 [c]	0.546
80	436 ± 6 [a]	304 ± 5 [c]	136.0±3.0 [e]	81.0±2.0 [e]			101.0±2.0 [d]	311.2±0.8 [d]	0.542
Tomato pizza garnished with sunflower oil									
				TP area	SO area				
0	440 ± 7 [a]	438 ±10 [a]	21.0±0.1 [a]	21.0±0.1 [a]	21.0±0.1[a]		21.0±0.1 [a]	350.0±3.0 [a]	0.555
20	438 ± 5 [a]	332 ±12 [b]	88.0±3.0 [b]	61.0±3.0 [b]	89.0±5.0[b]		74.0±3.0 [b]	349.4±0.1 [a]	0.554
40	437 ± 7 [a]	318 ± 5 [b,c]	115.0±5.0 [c]	73.0±2.0 [c]	100.0±4.0[c]		87.0±2.0 [c]	347.2±0.5 [b]	0.551
60	437 ± 6 [a]	313 ± 7 [b,c]	128.0±5.0 [d]	79.0±2.0 [d]	103.0±2.0[c]		93.0±2.0 [d]	344.7±0.3 [c]	0.547
80	436 ± 6 [a]	309 ± 7 [c]	141.0±2.0 [e]	84.0±2.0 [e]	106.0±2.0[c]		102.0±2.0 [e]	341.0±1.9 [d]	0.542
Tomato pizza garnished with sunflower oil and mozzarella cheese									
				TP area	SO area	MC area			
0	442 ± 9 [a]	437 ±12 [a]	21 ± 0.1 [a]	21.0±0.1 [a]	21.0±0.1[a]	15.0±0.1[a]	21.0±0.1 [a]	430.0±4.0 [a]	0.554
40	439 ± 4 [a]	336 ±10 [b]	98 ± 3 [b]	63.0±2.0 [b]	92.0±4.0 [b]	51.6±1.8 [b]	74.3±2.6 [b]	428.0±0.6 [a]	0.542

60	438 ± 7 [a]	325 ± 6 [b,c]	113 ± 3 [c]	73.0±2.0 [c]	98.0±3.0 [c]	55.0±2.0 [c]	86.7±2.0 [c]	427.0±0.6 [b]	0.540
80	436 ± 6 [a]	314 ± 7 [b,c]	130 ± 5 [d]	77.0±3.0 [c]	101.0±2.0 [c]	59.9±1.6 [d]	92.8±2.1 [d]	425.1±0.6 [c]	0.538
100	436 ± 5 [a]	307 ± 6 [c]	155 ± 5 [e]	87.0±2.0 [c]	110.6±3.4[d]	67.2±2.4 [e]	106.1±3.7 [e]	423.0±0.3 [d]	0.536

Mean values within the same parameter at different baking times followed by different superscript letters significantly differ by the Tukey test ($p<0.05$).

Table S3 Mean value and standard deviation of the empirical coefficients **a** and **b** of Eq. (1) and corresponding coefficient of determinations (r^2) for the water heating and pizza baking tests carried out in this work.

Sample	**a**	**b**	**r^2**
Water	-2.99±0.26	0.084±0.004	0.987
A) Pizza as such	-1.65±0.34	0.022±0.002	0.979
B) Pizza topped with SO	-3.13±0.52	0.035±0.004	0.977
C) Pizza topped with TP	-6.22±0.48	0.104±0.007	0.992
D) Pizza topped with TS and SO	-5.96±0.31	0.097±0.004	0.996
E) Pizza topped with TS, SO, and MC	-2.16±0.27	0.047±0.004	0.980

Table S4

Effect of baking time (t_B) on the percentage degree of browned (Y_{Br}) and blackened (Y_{Bl}) areas of the upper and lower area of different pizza samples A-E (cf. Table 1) during baking in a wood-fired oven. Each percentage is expressed as mean ± sd (n = 3).

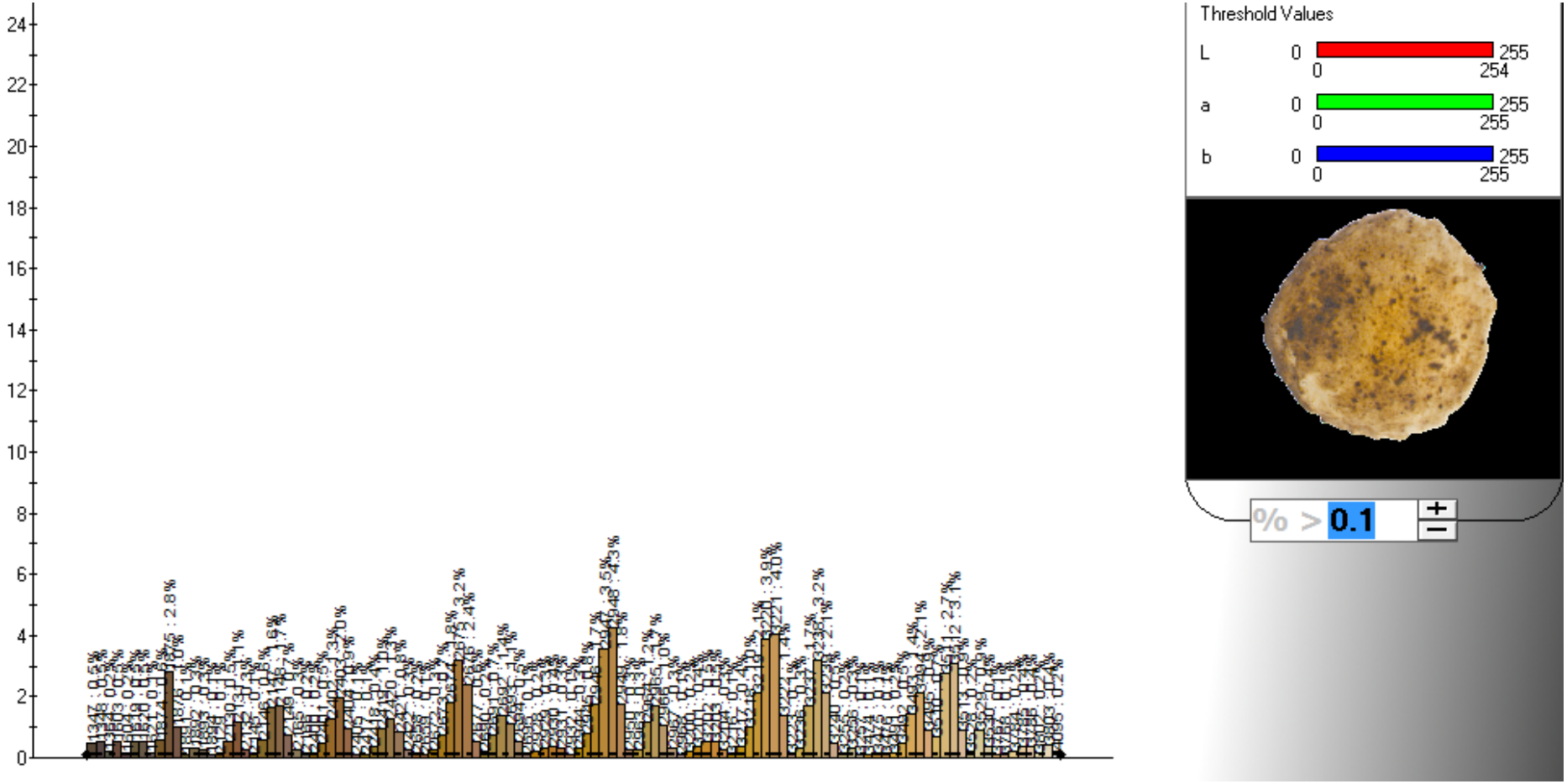
Pizza sample	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**
t_B (s)	**Browned area percentage Y_{Br} [%]**					**Blackened area percentage Y_{Bl} [%] (%)**				
Upper pizza side										
20	0.01±0.0	0.00±0.0	2.5±1.0			0.00±0.0	0.00±0.0	0.13±0.2		
40	0.3±0.2	0.07±0.1	3.1±1.2	1.9±0.3	0.08±0.1	0.03±0.1	0.00±0.0	0.5±0.3	0.00±0.0	0.00±0.0
60	4.7±1.0	2.1±1.5	8.2±2.0	4.3±0.5	0.3±0.1	0.38±0.1	0.8±1.7	1.7±0.8	0.09±0.1	0.17±0.0
80	26±5 ^{a}	8.6±1.6 ^{c,b}	11±2 ^{b}	10.7±5 ^{b}	2.3±0.1	7.9±6 ^{a}	1.4±1.1 ^{a}	2.9±0.1 ^{a}	3.2±2.0 ^{a}	0.6±0.1
100					7.3±0.3 ^{c}					3.95±0.3 ^{a}
Lower pizza side										
20	0.00±0.0	0.09±0.1	0.32±0.3			0.00±0.0	0.00±0.0	0.04±0.0		
40	0.03±0.0	0.2±0.3	1.0±0.4	1.3±0.9	0.13±0.0	0.00±0.0	0.00±0.0	0.13±0.1	0.05±0.0	0.04±0.0
60	0.06±0.1	0.11±0.5	4.7±1.7	1.4±1.4	0.40±0.0	0.00±0.0	0.00±0.0	0.56±0.1	0.07±0.0	0.14±0.0
80	1.4±1.2 ^{b}	0.3±0.2 ^{a}	7.6±1.2 ^{c}	5.9±1.0 ^{c}	1.7±0.1	0.01±0.0 ^{c}	0.00±0.0 ^{c}	0.87±0.4 ^{a,b}	0.37±0.2 ^{b}	0.80±0.1
100					2.8±0.1 ^{b}					0.94±0.1 ^{a}

Mean values within the same parameter at different baking times followed by different superscript letters significantly differ by the Tukey test ($p<0.05$).

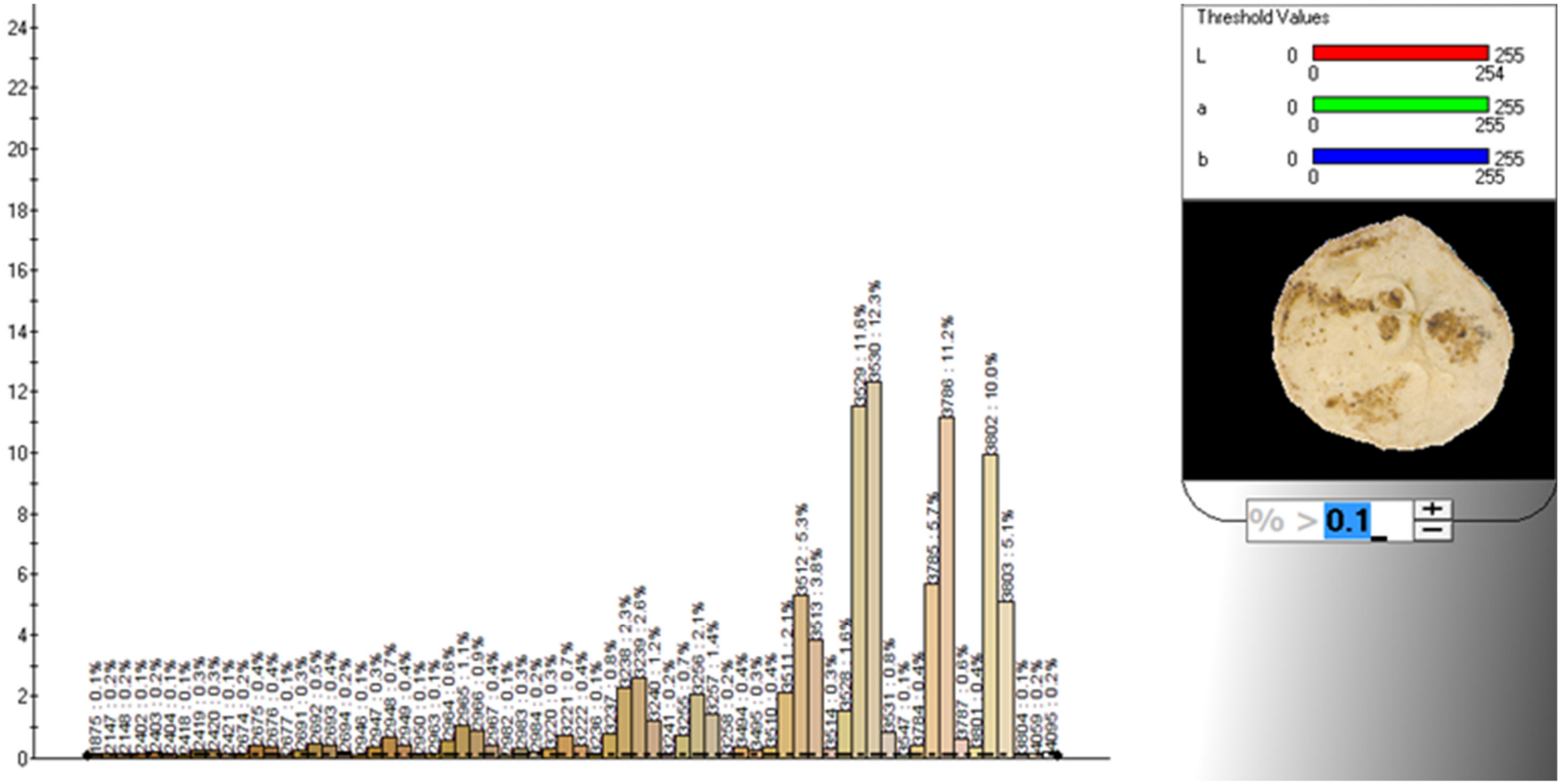
Figure S1
Front picture of the wood-fired pizza oven used in this work.

Figure S2
Color spectra of the upper and lower sides of pizza samples A-E (cf. Table 1) as baked in the pilot-scale wood-fired oven for 80 s showing the proportion (percentage of surface) of each unique color measured in a 4096-color space if greater than 0.1%.

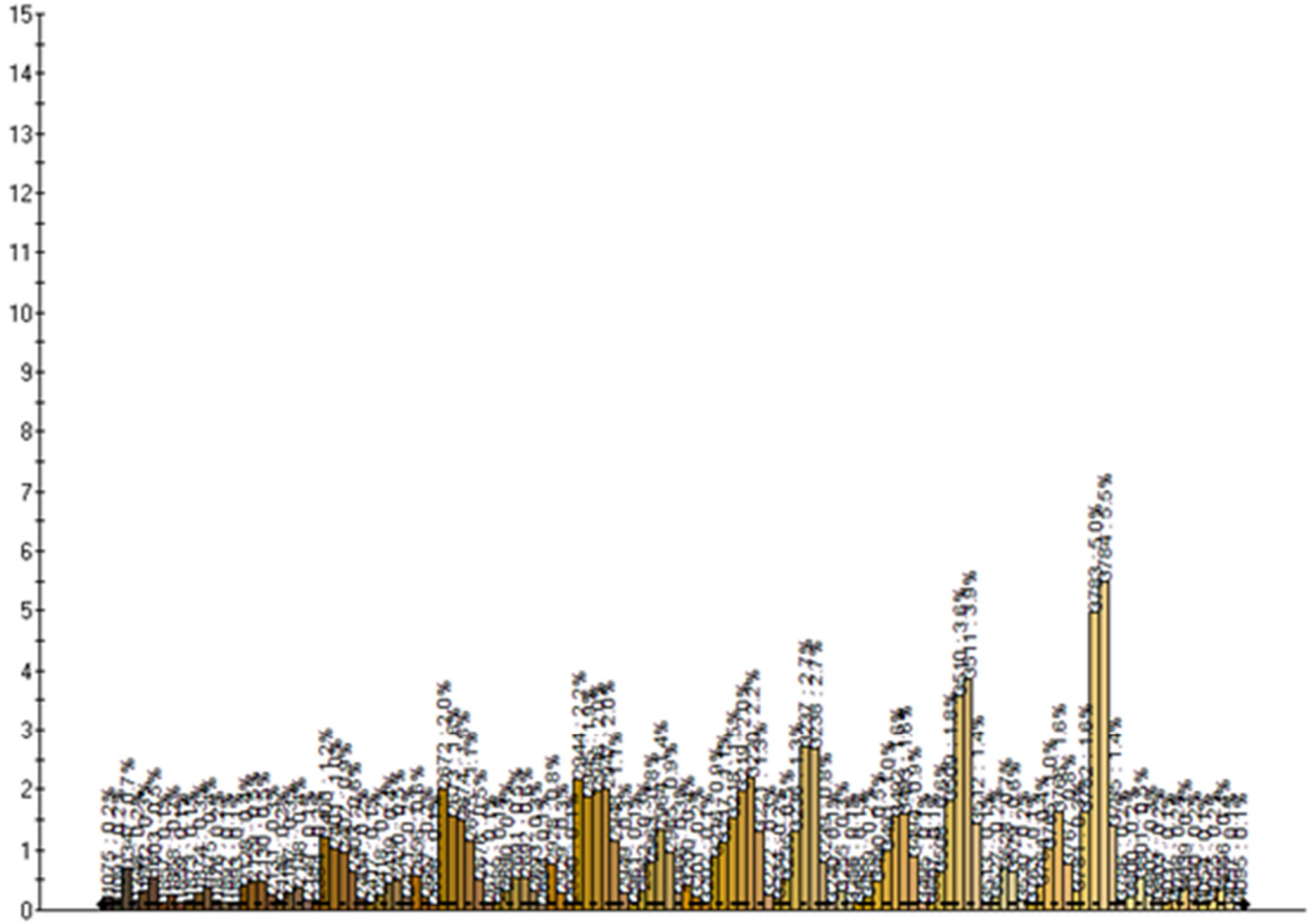
a) Upper side of pizza sample A

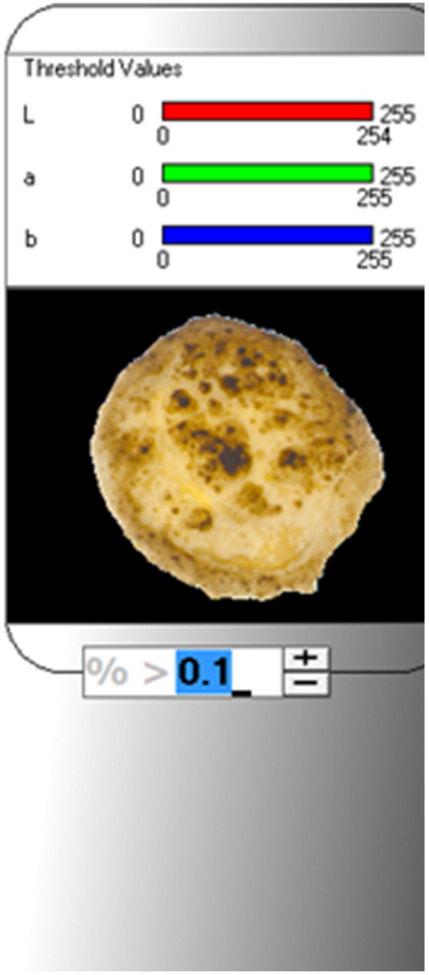


b) Lower side of pizza sample A

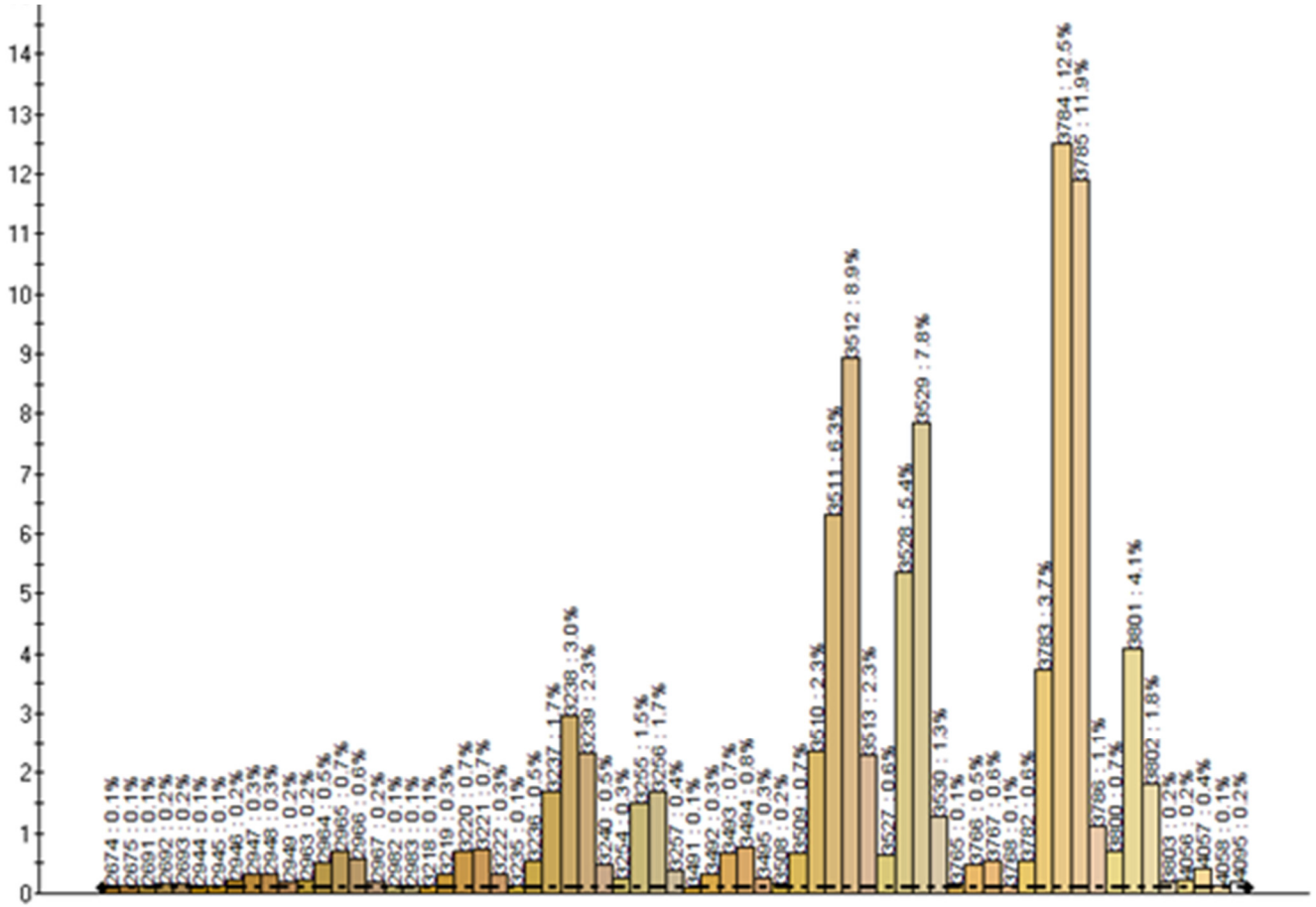


c) Upper side of pizza sample B

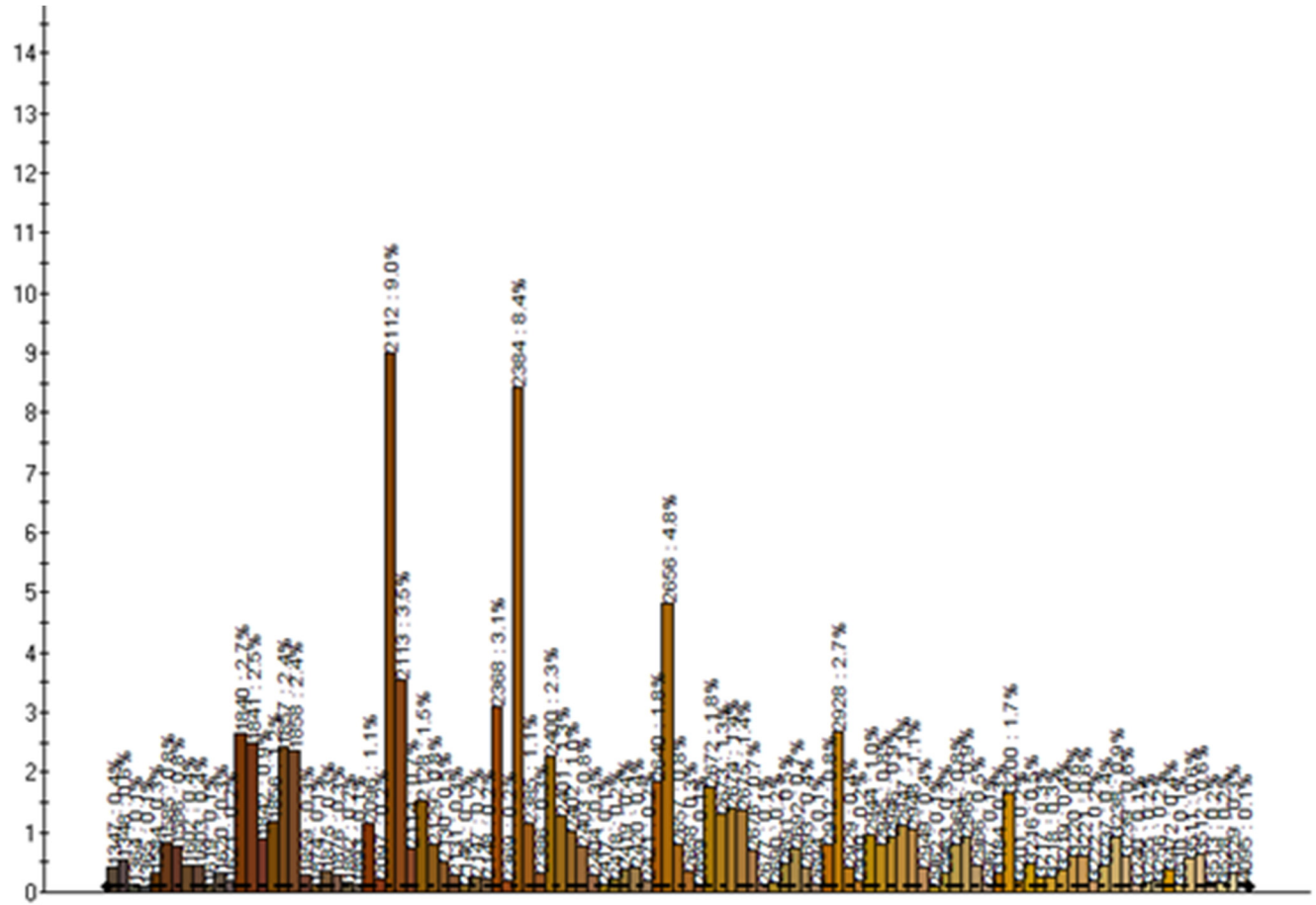


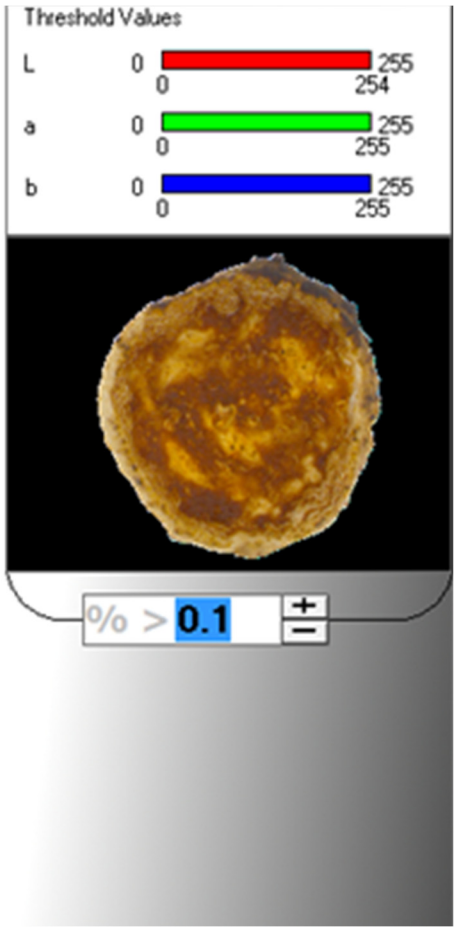


d) Lower side of pizza sample B

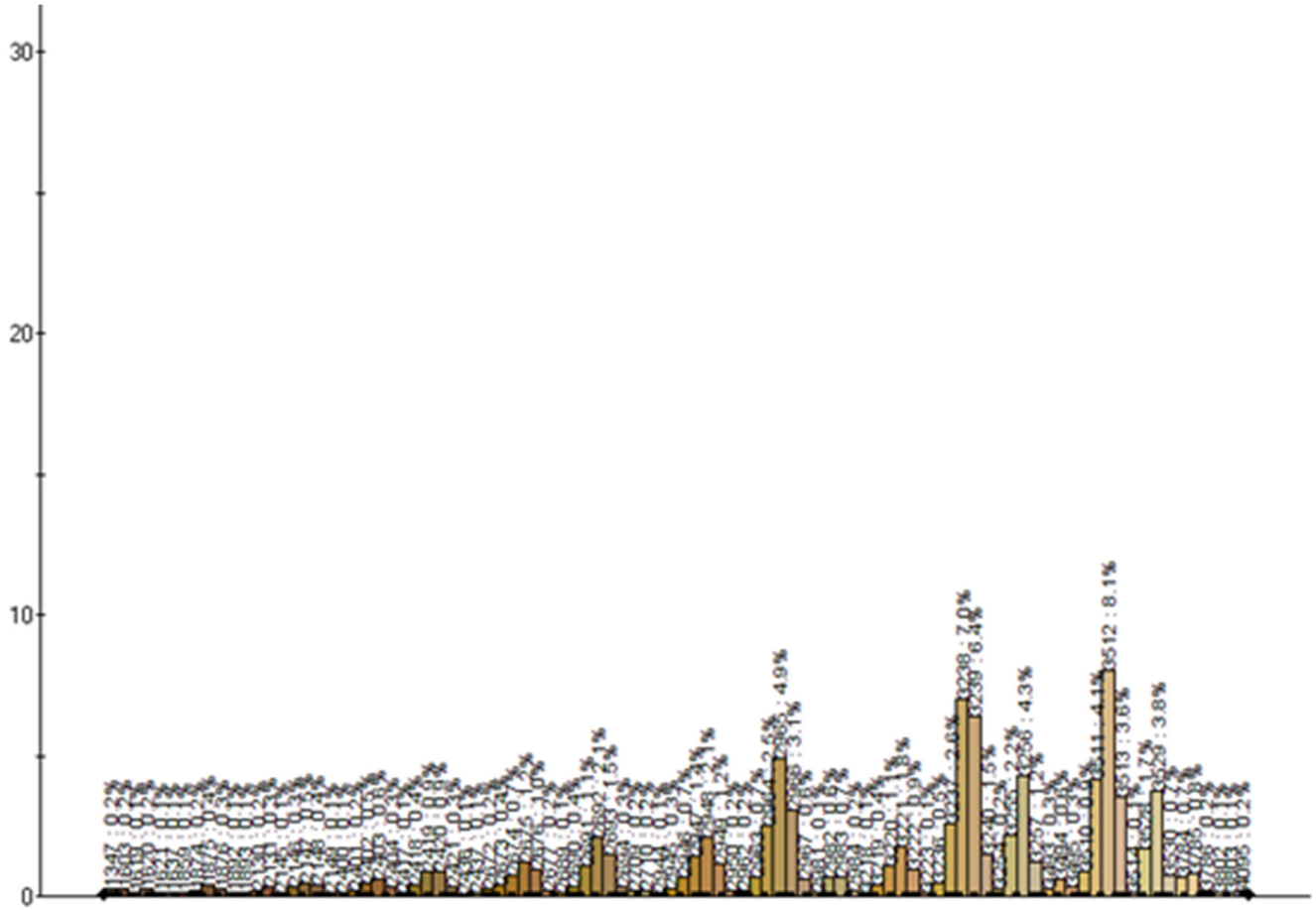


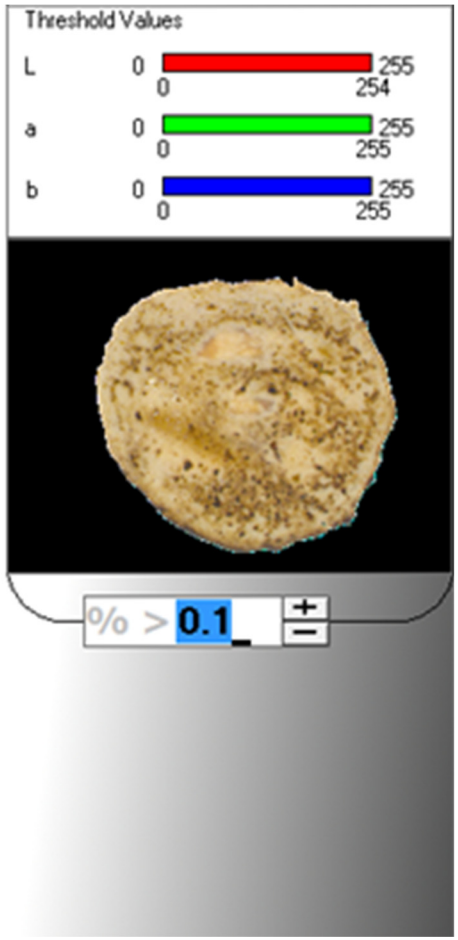
e) Upper side of pizza sample C



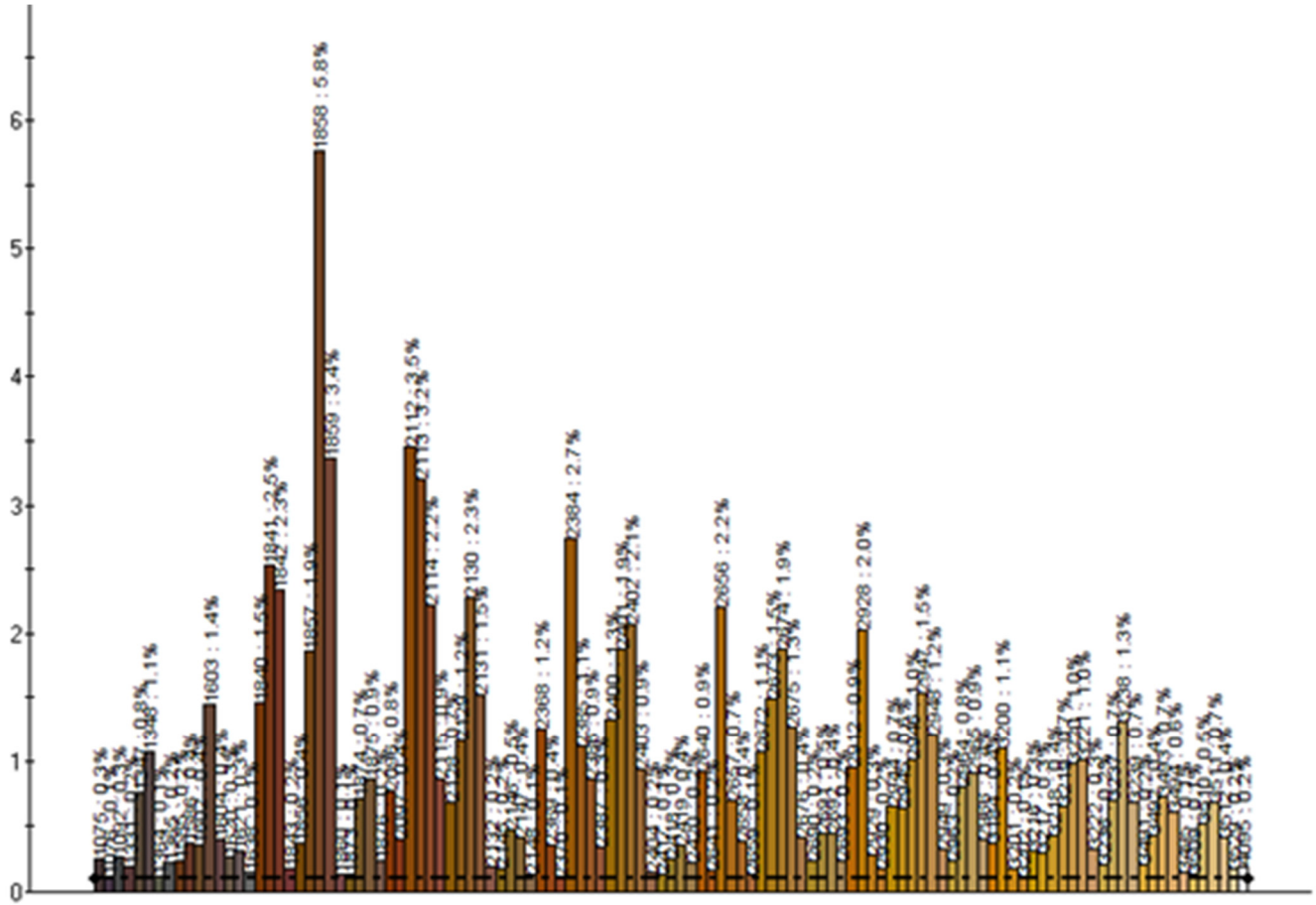


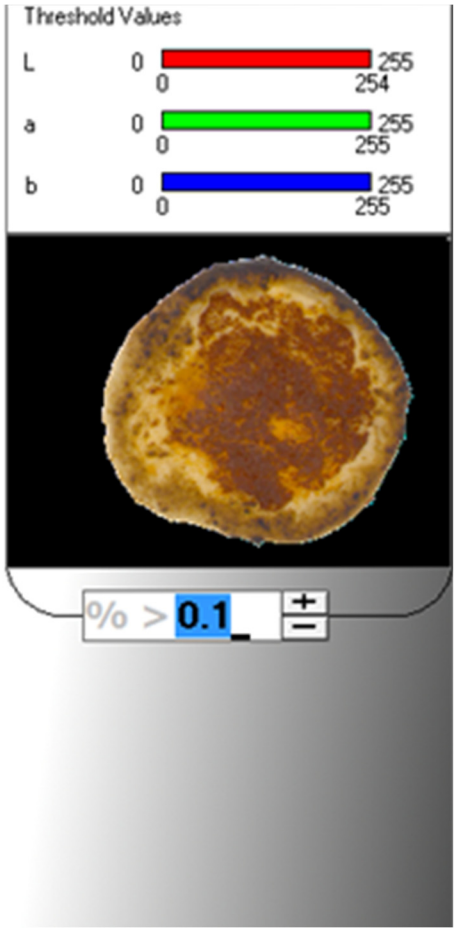
f) Lower side of pizza sample C



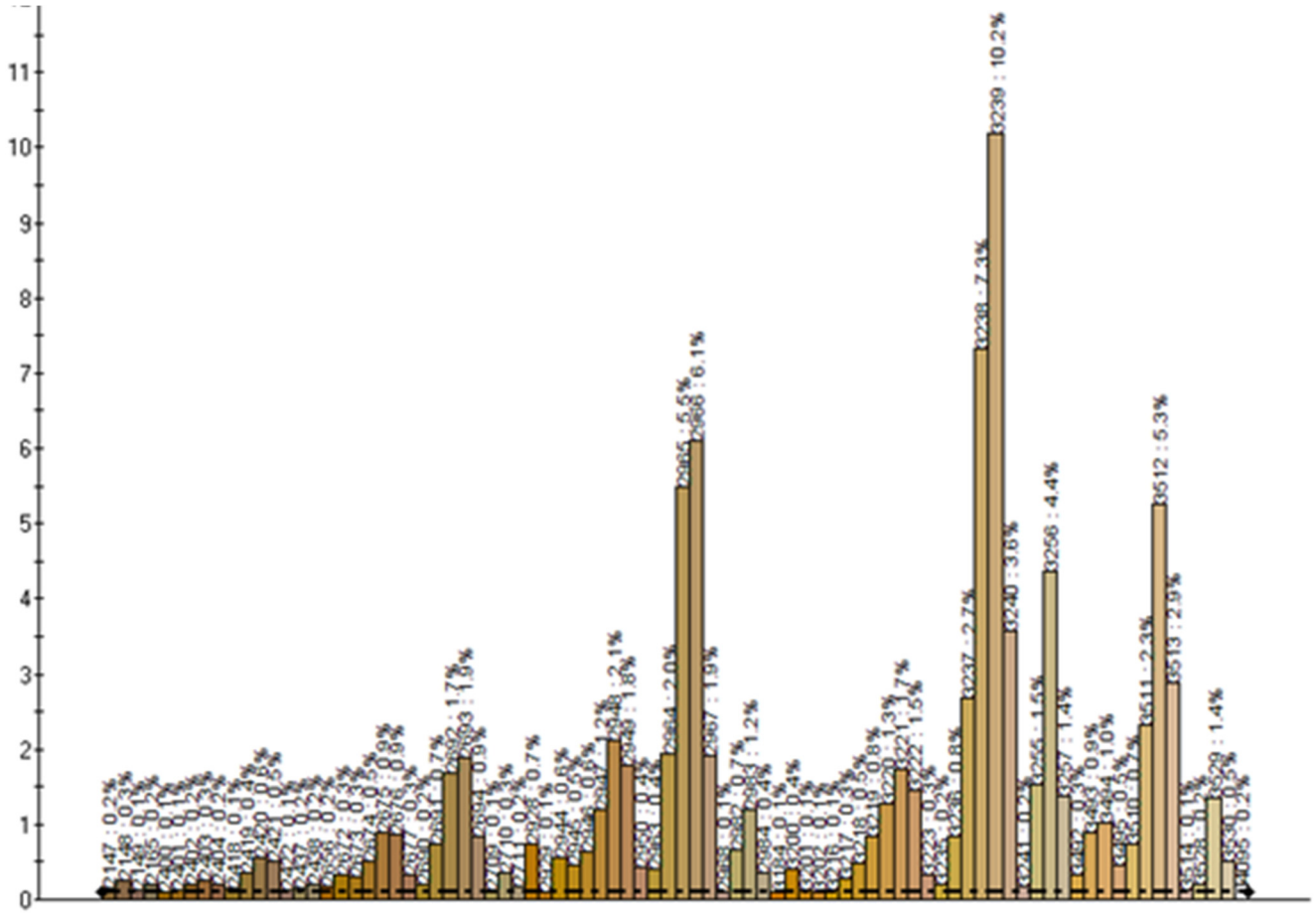


g) Upper side of pizza sample D

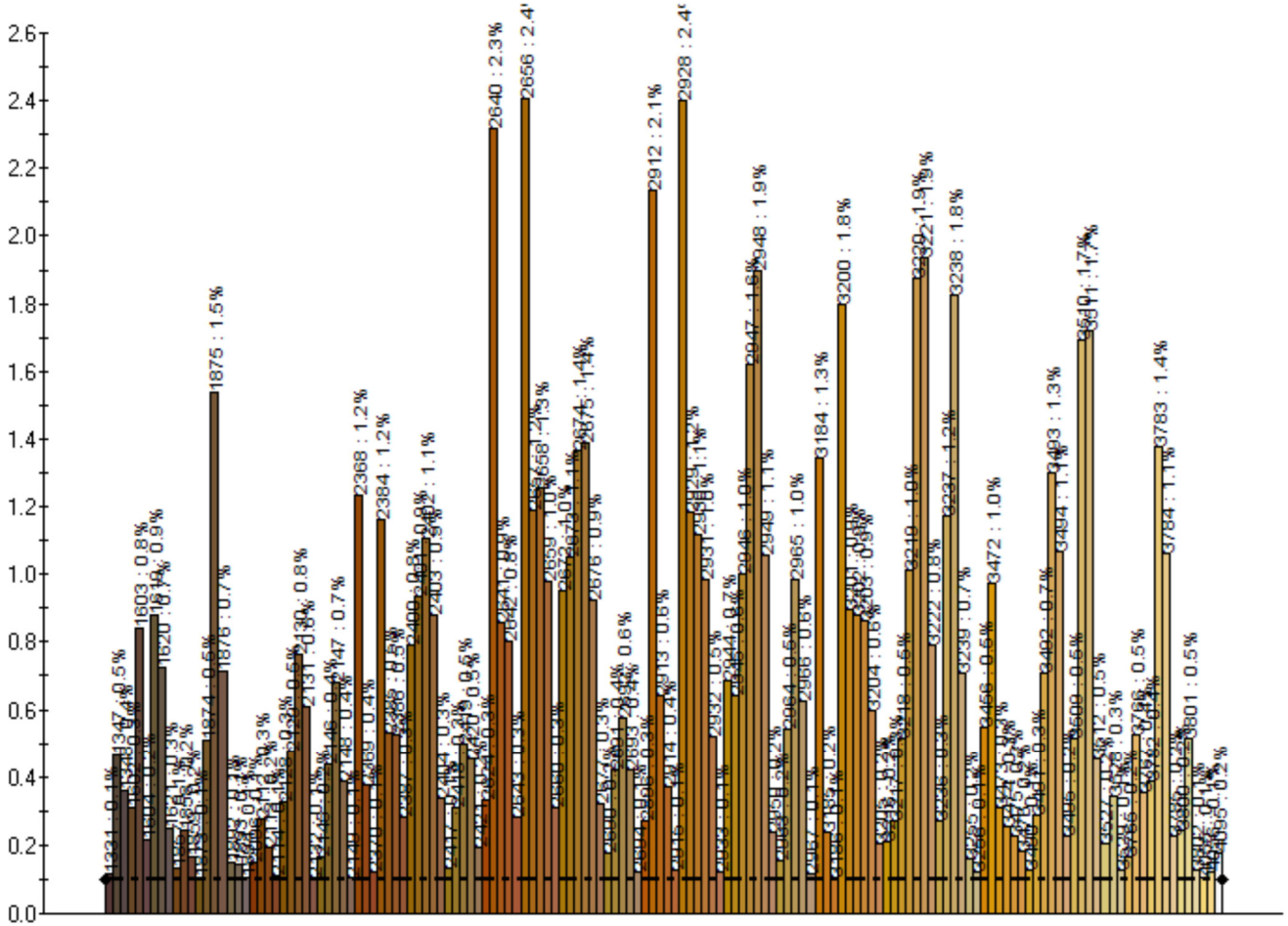


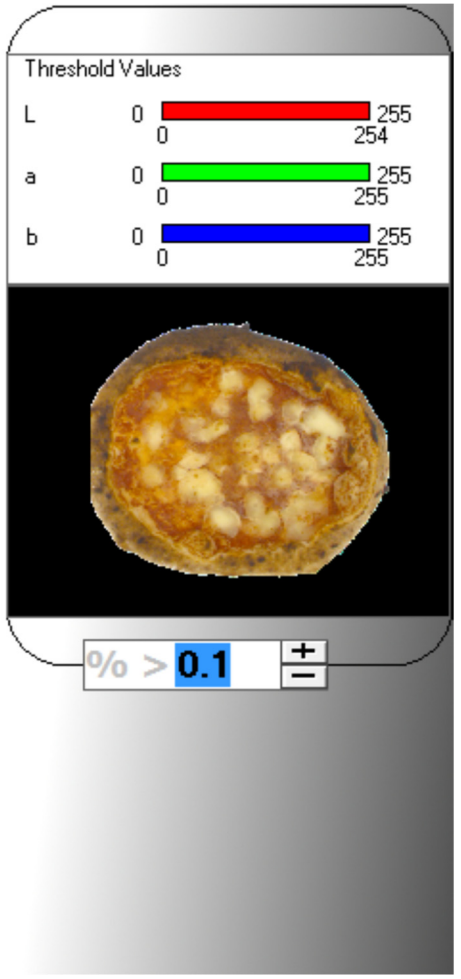


h) Lower side of pizza sample D



i) Upper side of pizza sample E





j) Lower side of pizza sample E