

Table S1. Standard recipe for production of Frankfurter sausages.

proportion (%)	Ingredient <sup>1</sup>
30	beef 80/20 (lean/fat)
30	pork 90/10 (lean/fat)
18	pork back fat
1.8	nitrite curing salt
0.2	sodium diphosphate
0.05	ascrobic acid
0.5	spice mixture „extra class sausages“
0.2	dextrose
1	fresh onions
0.1	garlic paste

<sup>1</sup> The meat, casings and additives were purchased from MEGA eG (Stuttgart, Germany) the spices from Frutarom Production GmbH (Freilassing, Germany).

Table S2. System control for the process steps smoking and cooking of frankfurter-type sausages. CA = Circulating air, TA = Transporting air, SA = Smoking air  
<sup>1</sup>Heating electrode: 132 s; Ignition suppression: 1s; wood chips transport: every 45 seconds for 3 seconds.  $t_K$  represents the variable smoking time

	process	t	T		Humidity	Fresh	Exhaust	CA	throttle	TA	SA	smoke
	step	[min]	[°C]		[%]	air	[%]	[%]	[%]	[%]	[%]	fan [%]
			chamber	surface		[%]						
1	shower	15 s	-	-	-	-	-	-	-	-	-	-
2	reddening	30	55	48	80	-	-	70	-	-	-	-
3	drying	12	50	-	-	100	100	70	-	100	100	-
4	smoking <sup>1</sup>	$t_K$	45- 55°C-	-	-	-	75	50	100	100	100	100
5	smoke		45-	-	-	50	50	30	100			
	circulation	5	55°C-									
6	cooking	20	75	-	97	-	-	80	-	-	-	-
7	evacuate	1	-	-	-	100	100	80				
8	shower	10	-	-	-	-	50	30	-	-	-	-
9	break + signal	-	-	-	-	-	-	-	-	-	-	-
10	evacuate	2	-	-	-	-	75	50	100	100	100	100

Table S3. Settings and resulting air volume flow for smoldering air and mean pyrolysis temperature applied in investigations (TA = transportation air, SA = smoldering air, SF = smoker fan). \*Hole diameters of TA and SA holes in hole plates: Plate S: SA: 5.60 mm, TA: 24.95 mm; Plate L: SA: 8.51 mm, TA: 37.90 mm.

Settings	Hole Plate	TA [%]	SA [%]	SF [%]	resulting pyrolysis temperature [°C]
Operation range	*	regulated by dampers in both feed pipes, 0-100 %	0-50 Hz, specified here as a proportion of the maximum frequency		
	L	100	100	100	900
	L	100	70	100 (at 750 °C switch to 35 Hz)	750
	S	100	100	100 (at 600 °C switch to 35 Hz)	600
	S	100	100	100 (at 450 °C switch to 20 Hz)	450
	S	100	100	70 (at 250 °C switch to 7.5 Hz)	300
	S	100	100	50 (at 150 °C switch to 5 Hz)	150

Table S4. Relative peak areas [%] of the substance classes carbonyls, furans, lactones in food smoke depending on pyrolysis temperature.

Pyrolysis temperature [°C]	Relative Peak Area [%]			
	carbonyls	furans	lactones	phenols
150	14.70 ± 1.31 <sup>a</sup>	14.68 ± 3.21 <sup>a</sup>	4.29 ± 1.37	66.33 ± 1.09 <sup>a</sup>
300	14.05 ± 0.78 <sup>a</sup>	11.83 ± 2.99 <sup>ab</sup>	3.96 ± 0.63	70.16 ± 1.59 <sup>a</sup>
450	9.76 ± 0.54 <sup>b</sup>	5.97 ± 1.15 <sup>c</sup>	3.68 ± 0.28	80.58 ± 1.94 <sup>b</sup>
600	10.61 ± 1.24 <sup>b</sup>	5.18 ± 0.80 <sup>c</sup>	4.43 ± 0.39	79.77 ± 2.19 <sup>b</sup>
750	10.5 ± 0.48 <sup>b</sup>	6.40 ± 1.19 <sup>bc</sup>	4.35 ± 0.25	78.75 ± 1.81 <sup>b</sup>
900	9.37 ± 0.41 <sup>b</sup>	6.39 ± 1.05 <sup>bc</sup>	4.25 ± 0.18	80.00 ± 1.62 <sup>b</sup>

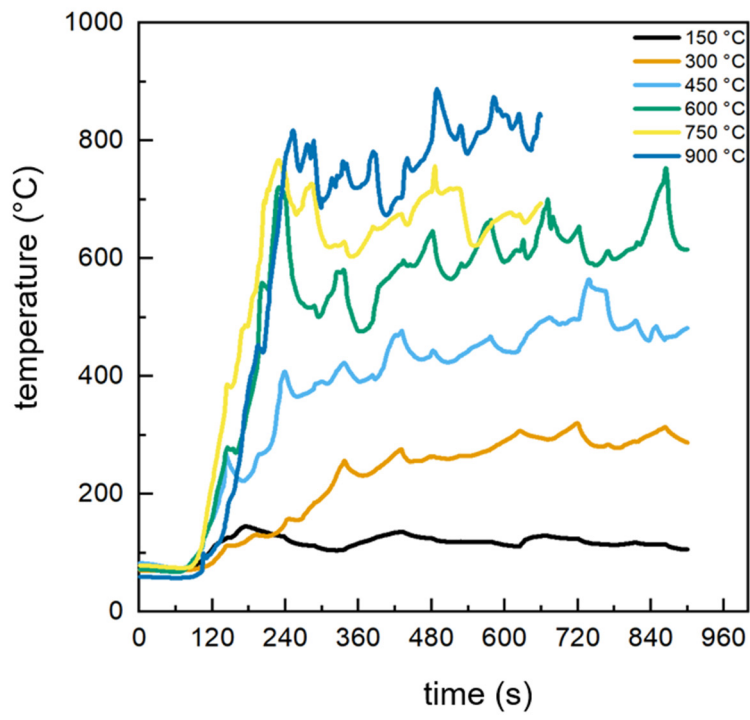


Figure S1: Temperature curves of smoldering zone temperature sensor while different approaches.