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# **Survey of Acrylamide and Furans in UK Retail Products: Summaries and Trends for Samples Purchased Between January 2014 and November 2018**

A report prepared for the Food Standards Agency

May 2019



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applied; samples purchased after this date were subject to BML legislation. The individual sample results for each Category and Survey year can be found in the Annual Survey Reports (see 6.2) available from the Agency.













Table 3 continued...

Food category / sub category <sup>a</sup>	Description	Sampling date <sup>b</sup>	n	Acrylamide (µg/kg)					n>IV
				mean	min	max	SE	IV <sup>c</sup>	
10.5	Other products, based on potatoes	2015	1	735	-	-	-	-	-
10.6	Other products, based on cocoa	2015	4	170	21	464	100	-	-
<b>11</b>	<b>Other products, not based on cereals, potatoes, cocoa and coffee</b>	<b>2015</b>	<b>12</b>	<b>392</b>	<b>9</b>	<b>884</b>	<b>95</b>	-	-
	Vegetable crisps	2015	4	727	514	884	78	-	-
	Black olives, canned	2015	2	525	331	720	-	-	-
	Prunes, canned	2015	2	248	72	424	-	-	-
	Liquorice candies	2015	2	51	35	68	-	-	-
	Dates / prunes	2015	2	72	9	134	-	-	-

<sup>a</sup> according to EFSA<sup>17,18</sup>; <sup>b</sup> products prepared from seasonal potatoes; <sup>c</sup> EC Indicative Values<sup>19</sup>

<sup>17</sup> European Food Safety Authority, 2014; Specific requirements for chemical contaminants' data submission. EFSA supporting publication 2014:EN-604. 25 pp.

<sup>18</sup> European Food Safety Authority, 2015; Specific requirements for chemical contaminants' data submission. EFSA supporting publication 2015: 2015:EN-833.

<sup>19</sup> Commission Recommendation of 8 November 2013 on investigations into the levels of acrylamide in food (2013/647/EU), oj L 301, 15-17, 12.11.13











	5.3	Bran products and whole grain cereals, gun puffed grain	2017	18	255	33	744	54.3	400	4
<b>6</b>		<b>Biscuits, crackers, crisp bread and similar (excluding pastry and cake)</b>	<b>2017</b>	<b>30</b>	<b>207</b>	<b>34</b>	<b>637</b>	<b>29.2</b>	<b>-</b>	<b>-</b>
	6.1	Crackers with the exception of potato based crackers	2017	6	224	60	470	77.8	500	0
	6.2	Crisp bread	2017	3	166	80	272	56.4	450	0
	6.3	Biscuits and wafers	2017	11	277	74	637	55.9	500	2
	6.4	Gingerbread	2017	4	80	39	182	34.0	1000	0
	6.5	Products similar to the other products in this category	2017	6	165	34	275	39.2	500	0
<b>7</b>		<b>Coffee and coffee substitutes</b>	<b>2017</b>	<b>20</b>	<b>375</b>	<b>6</b>	<b>1897</b>	<b>93.8</b>	<b>-</b>	<b>-</b>
	7.1	Roasted coffee (dry)	2017	8	131	94	164	8.8	450	0
	7.2	Instant coffee (dry)	2017	6	504	312	641	47.4	900	0
	7.3	Substitute coffee (dry) mainly based on cereals	2017	4	818	237	1897	379.5	2000	0
	7.4	Other coffee substitutes (dry)	2017	2	78	6	151	-	4000	0
<b>8</b>		<b>Baby foods , other than processed cereal based foods</b>	<b>2017</b>	<b>22</b>	<b>9</b>	<b>1</b>	<b>51</b>	<b>2.3</b>	<b>-</b>	<b>-</b>
	8.1	Baby foods not containing prunes	2017	20	9	1	51	2.4	50	1
	8.2	Baby foods, containing prunes	2017	2	11	8	14	-	80	0
<b>9</b>		<b>Processed cereal-based foods for infants and young children</b>	<b>2017</b>	<b>21</b>	<b>17</b>	<b>2</b>	<b>58</b>	<b>4.0</b>	<b>-</b>	<b>-</b>























Table 11. Distribution of furan concentrations in each survey category: 2016

Food category <sup>a</sup>	Description	Sampling date	n	Furan (µg/kg)			
				Mean <sup>b</sup>	min	max	SE
5	<b>Breakfast cereals (excluding porridge)</b>	2016	24	38	0	202	10
6	<b>Biscuits, crackers, crisp bread and similar (excluding pastry and cake)</b>	2016	30	35	0	216	9
7	<b>Coffee and coffee substitutes</b>	2016	20	1741	0	5440	435
	<b>Coffee and coffee substitutes, as consumed</b>	2016	20	48	0	166	15
	Roast	2016	8	3945	2499	5440	343
	Roast, as consumed	2016	8	118	7	166	20
	Instant	2016	6	414	135	555	65
	Instant, as consumed	2016	6	2	0	3	1
	Other	2016	6	130	0	424	64
	Other, as consumed	2016	6	1	0	4	1
8	<b>Baby foods, other than processed cereal based foods</b>	2016	22	31	2	108	5
10	<b>Other products, based on cereals, potatoes, cocoa and coffee</b>	2016	2	129	84	175	-
	Popcorn	2016	2	129	84	175	-
11	<b>Other products, not based on cereals, potatoes, cocoa and coffee</b>	2016	2	40	19	60	-
	Canned prunes	2016	2	9	8	9	-

<sup>a</sup> according to EFSA<sup>33,34</sup>; <sup>b</sup> Lower bound concentrations (values < LOD = 0)

<sup>33</sup> European Food Safety Authority, 2014; Specific requirements for chemical contaminants' data submission. EFSA supporting publication 2014:EN-604. 25 pp.

<sup>34</sup> European Food Safety Authority, 2015; Specific requirements for chemical contaminants' data submission. EFSA supporting publication 2015: 2015:EN-833.

Table 12. Distribution of furan concentrations in each survey category: 2017

Survey category	Description	Sampling date	n	Furan ( $\mu\text{g}/\text{kg}$ )			
				Mean <sup>a</sup>	min	max	SE
5	<b>Breakfast cereals (excluding porridge)</b>	2017	24	25	0	116	7.3
6	<b>Biscuits, crackers, crisp bread and similar (excluding pastry and cake)</b>	2017	30	31	0	108	6.0
7	<b>Coffee and coffee substitutes</b>	2017	20	1431	0	4498	345.2
	<b>Coffee and coffee substitutes, as consumed</b>	2017	20	37	0	179	11.9
	Roast	2017	8	3160	1564	4498	292.0
	Roast, as consumed	2017	8	88	22	179	17.7
	Instant	2017	6	439	147	592	67.9
	Instant, as consumed	2017	6	3	1	4	0.4
	Other	2017	6	116	0	486	76.0
	Other, as consumed	2017	6	1	0	5	0.7
8	<b>Baby foods, other than processed cereal based foods</b>	2017	22	23	0	98	4.8
10	<b>Other products, based on cereals, potatoes, cocoa and coffee</b>	2017	2	33	31	36	-
	Popcorn	2017	2	33	31	36	-
11	<b>Other products, not based on cereals, potatoes, cocoa and coffee</b>	2017	2	12	9	15	-
	Canned prunes	2017	2	12	9	15	-

<sup>a</sup> Lower bound concentrations (values < LOD = 0)

Table 13. Distribution of furan concentrations in each survey category: 2018

Survey category	Description	Sampling date	n	Furan ( $\mu\text{g}/\text{kg}$ ) <sup>a</sup>			
				Mean	min	max	SE
5	<b>Breakfast cereals (excluding porridge)</b>	<b>2018</b>	<b>32</b>	<b>23</b>	<b>0</b>	<b>94</b>	<b>4.5</b>
6	<b>Biscuits, crackers, crisp bread and similar (excluding pastry and cake)</b>	<b>2018</b>	<b>32</b>	<b>28</b>	<b>0</b>	<b>152</b>	<b>6.4</b>
7	<b>Coffee and coffee substitutes</b>	<b>2018</b>	<b>12</b>	<b>1159</b>	<b>70</b>	<b>4139</b>	<b>391.6</b>
	<b>Coffee and coffee substitutes, as consumed</b>	<b>2018</b>	<b>12</b>	<b>22</b>	<b>2</b>	<b>120</b>	<b>11.1</b>
	Roast	2018	4	2787	1809	4139	584.2
	Roast, as consumed	2018	4	58	6	120	26.3
	Instant	2018	6	422	165	599	60.2
	Instant, as consumed	2018	6	4	2	5	0.5
	Other	2018	2	116	70	161	-
	Other, as consumed	2018	2	2	2	3	-
8	<b>Baby foods, other than processed cereal based foods</b>	<b>2018</b>	<b>32</b>	<b>36</b>	<b>5</b>	<b>94</b>	<b>3.3</b>
9	<b>Processed cereal-based foods for infants and young children</b>	<b>2018</b>	<b>10</b>	<b>6</b>	<b>0</b>	<b>17</b>	<b>1.7</b>
11	<b>Other products, not based on cereals, potatoes, cocoa and coffee</b>	<b>2018</b>	<b>4</b>	<b>11</b>	<b>5</b>	<b>16</b>	<b>2.3</b>
	Canned / Jarred olives	2018	2	13	9	16	-
	Canned prunes	2018	2	9	5	13	-

<sup>a</sup> Lower bound concentrations (values < LOD = 0)



8	<b>Baby foods, other than processed cereal based foods</b>	2017	22	1	0	6	0.4
10	<b>Other products, based on cereals, potatoes, cocoa and coffee</b>	2017	2	18	17	19	-
	Popcorn	2017	2	18	17	19	-
11	<b>Other products, not based on cereals, potatoes, cocoa and coffee</b>	2017	2	0	0	0	-
	Canned prunes	2017	2	0	0	0	-

<sup>a</sup> Lower bound concentrations (values < LOD = 0); <sup>b</sup> extrapolated values (in excess of upper calibration limit)









Table 19. Distribution of 3-methyl furan concentrations in each survey category: 2018

Survey category	Description	Sampling date	n	3-methyl furan ( $\mu\text{g}/\text{kg}$ ) <sup>a</sup>			
				Mean	min	max	SE
5	<b>Breakfast cereals (excluding porridge)</b>	2018	32	0	0	0	0
6	<b>Biscuits, crackers, crisp bread and similar (excluding pastry and cake)</b>	2018	32	2	0	15	3.7
7	<b>Coffee and coffee substitutes</b>	2018	12	213	24	652	64.8
	<b>Coffee and coffee substitutes, as consumed</b>	2018	12	2	0	16	1.4
	Roast	2018	4	480	303	652	99.6
	Roast, as consumed	2018	4	7	1	16	3.4
	Instant	2018	6	98	73	125	7.24
	Instant, as consumed	2018	6	0	0	1	0.1
	Other	2018	2	26	24	28	-
	Other, as consumed	2018	2	0	0	0	-
8	<b>Baby foods, other than processed cereal based foods</b>	2018	32	3	0	10	0.43
9	<b>Other products, based on cereals, potatoes, cocoa and coffee</b>	2018	10	1	0	4	0.4
11	<b>Other products, not based on cereals, potatoes, cocoa and coffee</b>	2018	4	5	2	9	2
	Canned / Jarred olives	2018	2	9	8	9	-
	Canned prunes	2018	2	2	2	2	-

<sup>a</sup> Lower bound concentrations (values < LOD = 0)



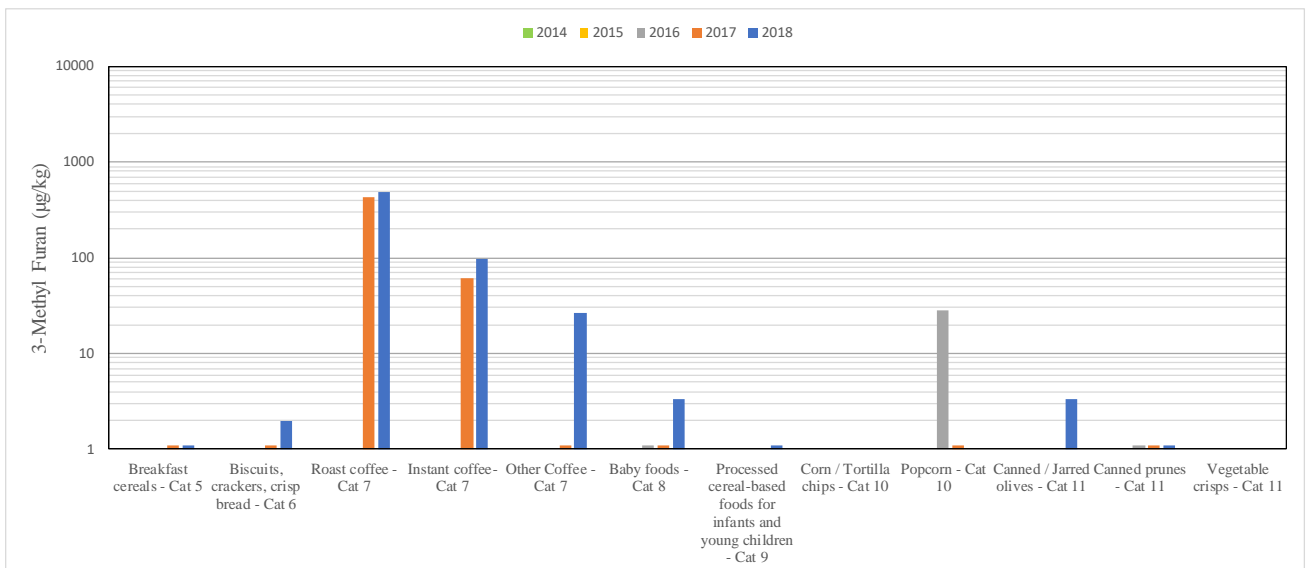
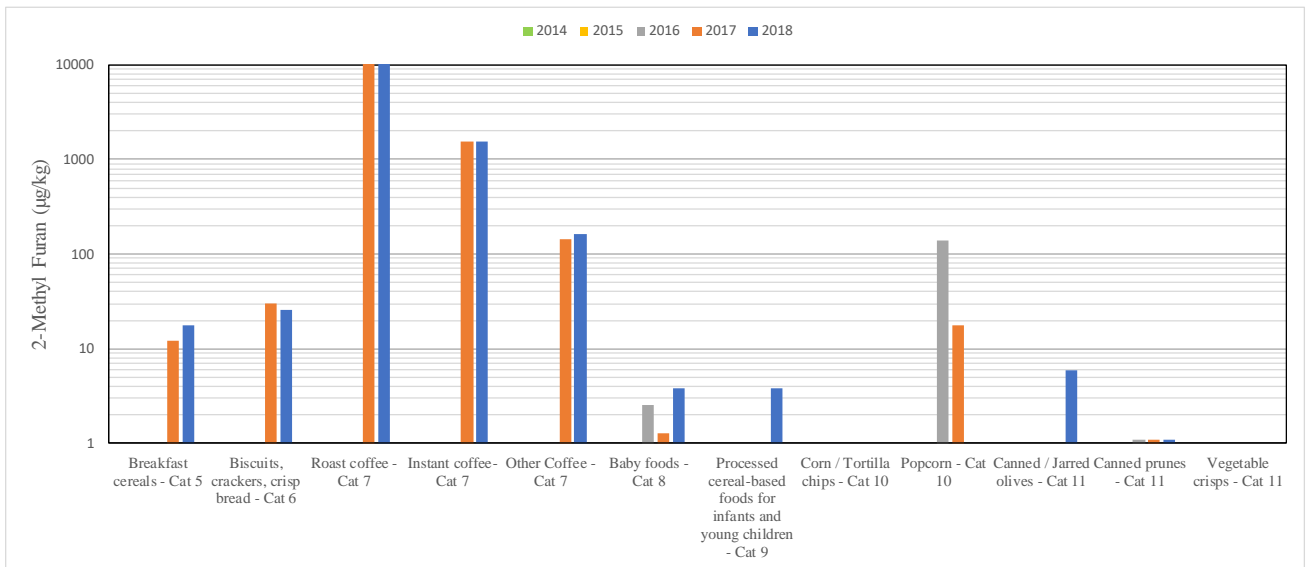
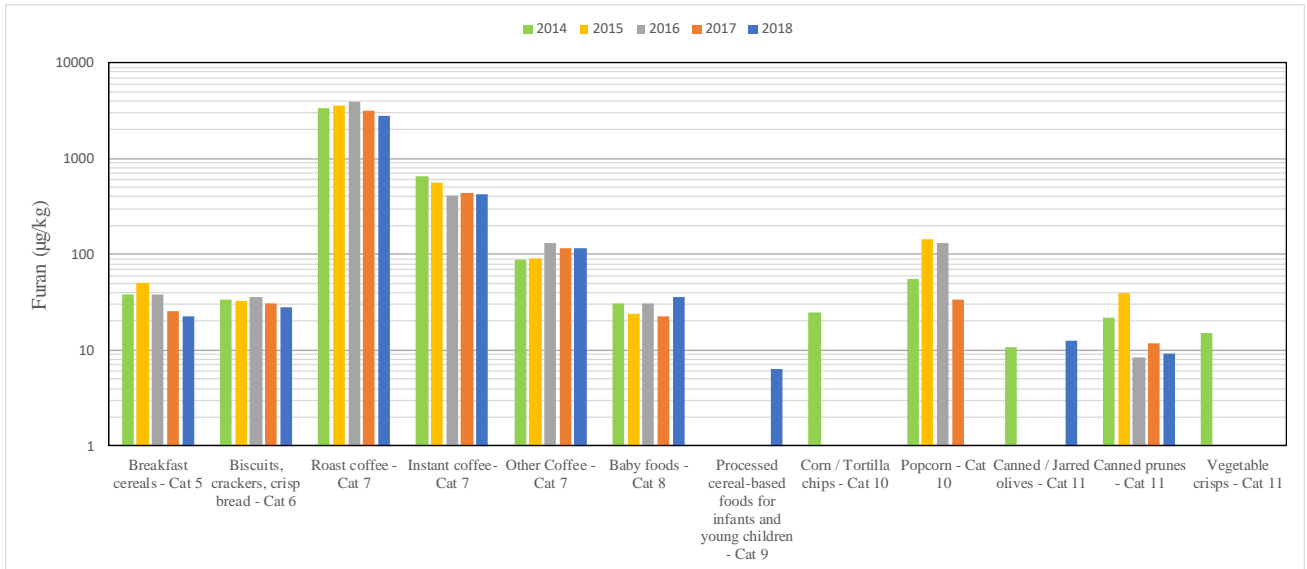


Figure 1. Comparison of the mean concentrations of furan, 2-methyl furan and 3-methyl furan in product categories tested for each survey year

### **5.2.5 Effects of domestic preparation on furans in coffee**

All samples from Category 7 were analysed as received and as consumed to determine potential losses of furans during domestic preparation. When the results as consumed were normalised to a solids basis, greatest losses of all furans (circa 60-75%) occurred during the preparation of the roast and ground coffees. The preparation of instant coffee on the other hand appeared to result in much less loss of furan and 2-methyl furan although it is not known if this effect was due to an enhanced “extraction” of each furan during the addition of hot water or in situ formation at elevated temperature. These results are summarised in Figure 8 (2018 data) and were consistent with previous findings for furan<sup>39</sup>.

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<sup>39</sup> Hamlet, C. G., Asuncion, L., & Liang, L., (2014) Survey of acrylamide and furan in UK retail products—analysis phase: Summary report for samples purchased between November 2011 and December 2013. Report No. C030 prepared for the UK Food Standards Agency. High Wycombe: Premier Analytical Services.

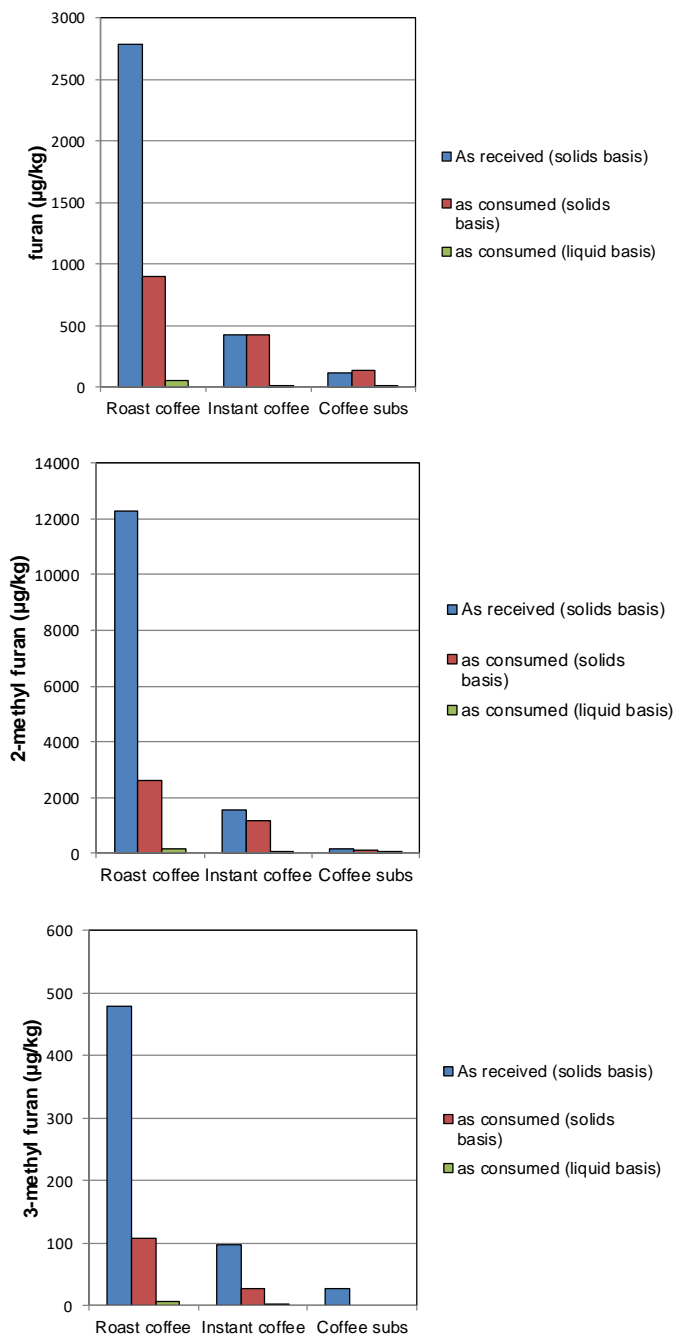


Figure 2. Effects of domestic preparation of coffee and coffee substitutes on amounts of furans: results are expressed as received and as consumed (solids and liquid basis)



## 6. Appendices

### 6.1 Sampling plan

Table 20. Sampling plan Jan - Nov 2014

		Sample numbers in product category																											
Category	1. French fries sold as ready to eat	2. Potato crisps and potato-based crackers			3. Pre-cooked French fries, potato products for home cooking			4. Soft bread	5. Breakfast cereals (excluding porridge)		6. Biscuits, crackers, crisp bread and similar (excluding pastry and cake)					7. Coffee and coffee substitutes				8. Baby foods, other than processed cereal based foods	9. Processed cereal-based foods for infants and young children		10. Other products, based on cereals, potatoes, cocoa and coffee					11. Other products, not based on cereals, potatoes, cocoa and coffee	Total
Sub category	1.1	2.1	2.2	2.4	3.1	3.2	3.3	4.1	5.1	5.3	6.1	6.2	6.3	6.4	6.5	7.1	7.2	7.3	7.4	8.1	9.1	9.2	10.2	10.3	10.4	10.5	10.6		
Month																													
Jan								20																					20
Feb									5	19																			24



## 6.2 Annual summary reports from this survey

The following annual summary reports for this Survey are available from the UK Food Standards Agency.

Hamlet, C. G., Liang, L., Andreou, A., & Carbone, L., (2016) Survey of acrylamide and furan in UK retail products: Summary report for samples purchased between January 2014 and November 2015. Report No. C037 prepared for the UK Food Standards Agency. High Wycombe: Premier Analytical Services.

Hamlet, C. G., Liang, L., Andreou, A., & Carbone, L., (2017) Survey of acrylamide and furan in UK retail products: Summary report for samples purchased between January 2016 and November 2016. Report No. C038 prepared for the UK Food Standards Agency. High Wycombe: Premier Analytical Services.

Hamlet, C. G., Liang, L., Baxter, B., & Apostilova, D., (2018) Survey of acrylamide and furans in UK retail products: Summary report for samples purchased between January 2017 and November 2017. Report No. C039 prepared for the UK Food Standards Agency. High Wycombe: Premier Analytical Services.

Hamlet, C. G., Liang, L., Baxter, B., Apostilova, D., & Ali, R., (2019) Survey of acrylamide and furans in UK retail products: Summary report for samples purchased between January 2018 and November 2018. Report No. C040 prepared for the UK Food Standards Agency. High Wycombe: Premier Analytical Services.