

Study on the release of chromium and nickel from Spanish food contact metal articles. Comparison of approaches in the estimation of the release. D. Sánchez, C. Cirugeda, J. Bustos*

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Introduction

Metals and alloys (M&A) are one group of materials included in the Framework Regulation on materials and articles intended to come into contact with food (Regulation EU No 1935/2004). They are widely used in the manufacture of different types of packaging and articles, including kitchenware. No European specific measure has been adopted for M&A, neither there is national legislation in Spain; however, as stated in the framework regulation, their use in food contact materials must guarantee their safety for the consumer. In 2013 the Council of Europe (CoE) published a Technical Guide, aimed at ensuring the safety and suitability of materials made from M&A. It also provides specific release limits (SRL) and technical information on analytical methods for release testing. The purpose of this study was to provide data on the current situation regarding the release of chromium and nickel from spanish food contact metal articles. The Technical Guide on M&A of the CoE was taken as reference for the release tests, as well as for the SRL. Additionally, results for not fillable articles were compared when using a 5 and 2 cm scale, and also following Regulation (EU) 10/2011 for plastic materials.

Samples

Results and discussion

Thirty commercial kitchen metal articles, including fillable (7) and not fillable (23) samples were assayed for chromium and nickel release. Samples were bought in retail outlets, covering 19 different brands, all manufactured in Spain. Three consecutive release tests were performed in 0,5 % citric acid, either by filling or immersion, depending on the type of article.

Testing release conditions

ARTIC (foreseeable con	TIME – TEMPERATURE (testing)	
FILLABLE ARTICLES T > 100 °C		2 h - boiling
hot filling and storage at ambient T for > 24 h		10 days- 40 °C
Non-FILLABLE ARTICLES T > 100 °C		2 h- 100 °C
hot use, not exceeding 100 °C		2 h– 70 °C





Graphite Furnace AAS Conditions

	Ni	Cr
Wavelength	232,0 nm	357,9 nm
Slit	0,2 L	0,7 L
Matrix modifier	-	Mg(NO 3) 2
Tube type	THGA	THGA with end caps
Sample volume	20 µl	20 µl
Modifier volume	-	10 µl

Perkin Elmer Model AA600

STEP	Temperature ^o C		Ramp Time(s)		Hold Time (s)		Flow gas (ml/min)	
	Ni	Cr	Ni	Cr	Ni	Cr	Ni	Cr
1	110	110	1	1	30	30	250	250
2	130	130	10	15	15	30	250	250
3	1100	1500	10	10	10	20	250	250
4	2300	2200	0	0	7	5	0	0
5	2600	2600	1	1	10	3	250	250
6	20	-	1	-	20	-	250	-

Validation Results

0,040 0,030 0,020 0,010	1 2 3 4 2 9 2 9 2 9 2 9 2 9 0,005 0,005 0,006 0,005 0,006 0,003 0,014 0,003 0,019 0,003 0,010 0,003 0,010 0,003 0,011 0,003 0,004 0,010 0,011 0,003 0,004 0,011 0,012 0,003 0,004 0,011 0,012 0,003 0,006 0,013 0,013 0,010 0,013 0,010 0,013 0,010 0,013 0,010 0,013 0,010 0,013 0,010 0,013 0,010 0,013 0,003 0,006 0,001 0,014 0,000 0,014 0,000 0,014 0,000 0,014 0,000 0,014 0,000 0,006 0,000 0,014 0,000 0,006 0,000 0,006 0,000 0,006 0,000 0,006 0,000 0,006 0,000 0,006 0,000 0,000 0,000 0,0		14 15 16 17 18 19	0 ⁰ 0 600 ⁰ 0 ⁰⁰⁰ 0 ⁰⁰ 0 20 22
				Sample
mg/kg		Ni, 5 cm scale	Ni, 2 cm scale	,373
פיי /פייי	Cr, Ni	Ni, surface calculation (Reg 10)	² 2011) Cr, 5 cm scale	000
0,370	NON-FILLABLE ARTICLES	Cr, 2 cm scale	Cr, surface calculation (Reg 10/201	1) (0
0,350	3rd Roloaco tost	••••••Ni SRL= 0.14 mg/kg	Cr SRL= 0.250 mg/kg	
0,330	J NEIEdse lest		0, 0	
0,310				
0,290				
0,270				
0,250 -				
0,140				
0,120				
0,100		,081	m	
0,080		0,064	0,07	
0,060	33 0,043	0,050	0,050	0,048
0,040	12 0,025 0,020 0,032	11		,013

Metal				N	li				Cr		
Concentration		4 μg/kg (LoQ)	20 µg/kg	140 μg/kg	300 µg/kg	5 µg/kg (LoQ)	10 µg/kg	50 μg/kg	250 µg/kg	500 μg/kg	
Accuracy (%)	Precision (%)	r (%)	2.8	2.5	1.2	1.3	1.2	2.0	0.8	1.3	1.8
		R (%)	11.0	6.2	5.2	2.6	5.1	3.8	3.2	4.6	4.5
	Recovery (%)		103.1	102.3	107.4	104.8	103.0	107. <mark>7</mark>	96.9	99.2	98.7
Uncertainty (%) (k= 2)		22.0	12.4	10.3	5.3	10.3	7.5	6.5	9.1	9.1	
series (duplicate analysis)		8	7	7	7	6	7	6	7	7	

References

- 1. "Metals and Alloys in food contact materials and articles" (2013, 1st Edition, EDQM-Council of Europe).
- 2. "Guidelines on testing conditions for articles in contact with foodstuffs" (2009, 1st Edition. EUR 23814 EN 2009).
- Commission Regulation (EU) No 10/2011 of 14 january 2011 on plastic materials and articles intended to come into contact with food.



Conclusions

Results for all articles were in compliance with the SRL for chromium and nickel (Technical Guide on M&A, CoE 2013). The envelope volume concept for estimating the amount of food in contact, based on a 5 cm scale, following the Technical Guide on M&A of CoE, led always to significant lower release values, while higher and more similar values were obtained when using a 2 cm scale and the approach for plastic materials (Reg (EU)10/2011). One out of the 30 articles tested would be above the SRL for chromium, if the estimation of the amount of food in contact was done according to the plastic regulation and when using the envelope volume concept with a 2 cm scale.

Having a harmonized procedure, independent of the material type, to estimate the food amount in contact in real use would be more convenient.

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