

A new measurement campaign confirms the insignificance of metals migration in European flat glass products

For understandable public health concerns and environmental considerations, European authorities are keen to ensure that heavy metals are not released in food. Metals are not intentionally added in clear soda-lime silicate flat glass, except for aluminium¹, therefore their presence may only derive from traces of naturally occurring circumstances. Iron and cobalt may be added to produce coloured soda-lime silicate flat glass².

To quantify the potential release of metals from soda-lime flat glass, Glass for Europe commissioned an independent institute to undertake an unprecedented measurement campaign on flat glass products from all over Europe, both clear and coloured glass.

This measurement campaign, whose methodology and results are presented on the next pages, confirms that all types of soda-lime silicate flat glass products made in Europe present migration levels which are so low that, even when using the most precise analytical technologies (ICP-MS), most migration results are below the measurable limit of quantification.

- ▶ For 16 of the 18 tested metals, the releases measured were under the limit of quantification (LQ). It is the case for cobalt, barium, lithium, chromium, copper, manganese, molybdenum, aluminium, antimony, arsenic, nickel, titanium, zinc, boron, lead and cadmium.
- ▶ For iron³, two of the sixteen tested samples showed release values above the limit of quantification (LQ) of 4,45µg/dm². The maximum release measurement was 5,61µg/dm² that is equivalent to 0.03mg/kg⁴. This value is 1000 times under the current release limit of 40mg/kg defined in the resolution CM/Res2013/9 of the Council of Europe⁵ on metals and alloys used in food contact materials.
- ▶ Concerning tin⁶, all except two of the flat glass samples tested showed release. The maximum measurement value was 44,0µg/dm², which is equivalent to 0.26mg/kg. This is 200 times below the limit value set up in the EU Regulation 1881/2006⁷ of 50 mg/kg directly contained within baby foodstuff.

¹ Aluminium is one of the metals found in the flat glass matrix. It is a constituent of feldspar, which is one of the raw materials to produce flat glass. Its proportion by mass in soda-lime silicate flat glass is between 0 to 1.6%.

² Cobalt and iron are sometimes added to raw materials to produce coloured glass, i.e. blue or green glass. There is however no trace of release for cobalt in all 16 tested samples while release of iron is detected in two samples.

³ Iron is added intentionally in the mix of raw materials to give glass a greenish effect. To increase the glass transparency, which is essential for building glass, iron content is minimised which explains why release is found for two of the sixteen samples.

⁴ A factor of 6 dm²/kg is used to convert a surface release into a volume release value. This conversion factor is inappropriate to flat glass products which can only have one contact surface: a flat piece and not a closed container. The factor of 6 therefore largely overestimates migration levels for flat glass and represents an overly conservative approach.

⁵ https://search.coe.int/cm/Pages/result_details.aspx?ObjectID=09000016805c8094 and https://www.edelstahlrostfrei.de/downloads/iser/CoE-Guidelines_EN.pdf

⁶ Released tin is not coming from raw materials but comes from a step in the manufacturing process. 90% of flat glass in the EU is manufactured by way of the float process, whereby molten glass floats on top of a tin bath immediately after exiting the furnace. Cast and rolled glass, whose production does not require molten glass to 'float' on tin, tin release levels were below the LQ.

⁷ <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32006R1881>



1. Overview of the analysis

Samples analysed

The study covered all main types of flat glass produced in Europe, i.e. float glass both clear and coloured, low iron glass, bronze glass as well as clear patterned glass.

The sixteen flat glass samples analysed were collected from European manufacturing plants located in twelve countries across Europe. The study therefore covers all EU countries where Glass for Europe members operate glass making sites.

Countries of origin of samples	Types of glass analysed
Belgium, Bulgaria, Czech Republic, France, Germany, Hungary, Italy, Luxembourg, Poland, Romania, Spain and United Kingdom	<i>clear float glass / 10 samples</i>
	<i>coloured float glass / 2 samples</i>
	<i>low iron glass / 2 samples</i>
	<i>clear patterned glass / 2 sample</i>

Laboratory and methodology

The tests and analyses were performed by the 'Stazione Sperimentale del Vetro' (SSV) in Italy. SSV is an independent accredited laboratory, specialized in glass and glazing processes and products. Samples and results were anonymised by the institute to ensure complete independence and confidentiality of results.

The migration test followed the ISO standard 6486-1:1999⁸ (acetic acid at 22°C for 24 hours). The migration solutions were then analysed by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) according to EPA 6020B:2014.

2. Results and conclusions of the study

Results:

The average values and the standard deviation (where applicable) of all samples analysed are presented in the next page, both in terms of concentration in the solution (µg/l) and specific migration per glass surface (µg/dm²). The Limit of Quantification (LQ) used are also presented.

⁸ ISO 6486-1:1999: "Ceramic ware, glass-ceramic ware and glass dinnerware in contact with food. Release of lead and cadmium" Part 1: Test method)





Element	Limit of quantification (LQ)	Average values	
		µg/l	µg/dm ²
Aluminium	10	< 10	< 0.89
Arsenic	1	< 1	< 0.089
Barium	10	< 10	< 0.89
Boron	10	< 10	< 0.89
Cadmium	0,5	< 0,5	< 0,045
Cobalt	1	< 1	< 0.089
Chromium	1	< 1	< 0.089
Copper	1	< 1	< 0.089
Iron	50	< 50 ⁹	< 4,45
Lithium	1	< 1	< 0.089
Manganese	1	< 1	< 0.089
Molybdenum	1	< 1	< 0.089
Nickel	1	< 1	< 0.089
Lead	0,5	< 0,5	< 0,045
Antimony	1	< 1	< 0.089
Tin	10	225 ± 142 ¹⁰	20 ± 12,6
Titanium	1	< 1	< 0.089
Zinc	10	< 10	< 0.89

⁹ Only 2 samples released iron with measured values above and very close to the LQ. For all the other samples, the release values were below the LQ. Therefore, SSV concluded that in average, the iron release was below the LQ

¹⁰ Considering that most of the samples released tin, the average value has been calculated by SSV considering the results inferior to the LQ as equal to the LQ



Conclusion

- ▶ For 16 of the 18 tested metals, the releases measured were under the limit of quantification (LQ). It is the case for cobalt, barium, lithium, chromium, copper, manganese, molybdenum, aluminium, antimony, arsenic, nickel, titanium, zinc, boron, lead and cadmium.
- ▶ For iron¹¹, two of the sixteen tested samples showed release values above the limit of quantification (LQ) of 4,45µg/dm². The maximum release measurement was 5,61µg/dm² that is equivalent to 0.03mg/kg¹². This value is 1000 times under the current release limit of 40mg/kg defined in the resolution CM/Res2013/9 of the Council of Europe¹³ on metals and alloys used in food contact materials.
- ▶ Concerning tin¹⁴, all except two of the flat glass samples tested showed release. The maximum measurement value was 44,0µg/dm², which is equivalent to 0.26mg/kg. This is 200 times below the limit value set up in the EU Regulation 1881/2006¹⁵ of 50 mg/kg directly contained within baby foodstuff.

When addressing issues of release of heavy metals in flat glass products, European decision-makers should carefully consider whether or not additional testing requirements bring any added-value, in light of the insignificance of release and migration shown by this analysis.

Glass for Europe is the trade association for Europe's flat glass sector. Flat glass is the material that goes into a variety of end products, primarily in windows and facades for buildings, windscreens and windows for automotive and transport as well as solar energy equipment, furniture and appliances. Glass for Europe brings together multinational firms and thousands of SMEs across Europe, to represent the entire building glass value-chain. It is composed of flat glass manufacturers, AGC Glass Europe, Guardian, NSG Group, Saint-Gobain Glass Industry and Siseçam-Trakya Cam, and works in association with national partners gathering thousands of building glass processors and transformers all over Europe.

¹¹ Iron is added intentionally in the mix of raw materials to give glass a greenish effect. To increase the glass transparency, which is essential for building glass, iron content is minimised which explains why release is found for two of the sixteen samples.

¹² A factor of 6 dm²/kg is used to convert a surface release into a volume release value. This conversion factor is inappropriate to flat glass products which can only have one contact surface: a flat piece and not a closed container. The factor of 6 therefore largely overestimates migration levels for flat glass and represents an overly conservative approach.

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