Application Brief

Food

Agilent

Trusted Answers

Monitoring Compliance with Heavy Metals Limits in Baby Food

Agilent 7850 ICP-MS offers robust, sensitive, and flexible analysis to help ensure baby food safety

Protecting the health and development of infants

An investigative committee in the U.S. House of Representatives issued a report in February 2021 showing that many baby foods sold in US supermarkets contained unacceptably high concentrations of As, Cd, Pb, and Hg. These findings led to the development of the Baby Food Safety Act 2021. The Act sets out maximum levels of inorganic As (the most toxic form of As), Pb, Cd, and Hg permitted in baby foods sold in the US (Table 1). Currently, the U.S. Food and Drug Administration (FDA) has published action level guidance for industry for inorganic arsenic (iAs) in rice cereals for infants, which is the same level as in the European Union (EU). In response to the Act, the FDA has also outlined the Closer to Zero action plan for baby foods.

Table 1. Proposed maximum allowable limits of metals in infant and toddler foods. Units: ppb.

Analyte	Proposed Action Level		Current FDA Guidance Level	EU Maximum Level	China**
	Non-cereal	Cereal-foods	Rice cereal	Rice	Cereal
Inorganic Arsenic*	10	15	100	100	200
Cadmium	5	10	-	-	-
Lead	5	10	-	-	-
Mercury	2		-	-	-

**Speciation analysis for iAs commonly uses HPLC-ICP-MS. ** 100 ppb iAs max level in canned foods*

Monitor foods at new action-level limits with ICP-MS and HPLC-ICP-MS

An Agilent 7850 ICP-MS was used for the analysis. The 7850 is equipped with an ORS^4 collision cell for control of polyatomic interferences and UHMI aerosol dilution technology for handling high matrix samples. Eleven different infant food samples, three food standard reference materials, and quality control samples were prepared using microwave acid digestion. Samples were introduced using an Agilent SPS 4 autosampler.

Simple interference removal

Food samples with high and variable solids content can be difficult to analyze by ICP-MS due to the formation of variable and unpredictable matrix-based polyatomic interferences. The Agilent ORS^4 cell is the optimum configuration for helium (He) collision mode, effectively reducing all common matrix-based polyatomic interferences under one set of standard cell conditions.

Also, some plant-based food samples can contain rare earth elements (REEs) at a high enough concentration to form REE interferences that affect the accuracy of the measurement of As and Se. Selecting REE Correction in the ICP-MS MassHunter method wizard applies a half mass measurement and real time correction to ensure accurate analysis of As and Se in these sample types.

SRM and sample spike recoveries

A NIST baby food composite SRM was prepared in duplicate, and each preparation was analyzed twice (with three replicates per analysis). The mean concentrations were in good agreement with the certified concentrations (Table 2). In addition to the NIST SRM, several commercial baby foods were analyzed, both unspiked and fortified with a low- and high-level spike. The recoveries for all elements in the fortified beef medley sample were within ±15% (Table 2).

Table 2. Recoveries of certified elements in SRM and sample spike recoveries.

	NIST 2383a Baby Food Composite			Fortified Beef Medley	
Element	Certified Conc (µg/kg)	Measured Conc (µg/kg)	Recovery (%)	Low Spike Recovery (%)	High Spike Recovery (%)
^{52}Cr	-	-	-	99	90
^{55}Mn	963	972	101	*	92
^{63}Cu	-	-	-	102	94
^{66}Zn	758	749	99	87	96
^{75}As	2220	2156	97	*	91
^{78}Se	-	-	-	104	100
^{98}Mo	28^R	26	-	96	93
^{137}Ba	-	-	-	98	93

*^{R} Noncertified reference value. *Spike levels were too low (<5%) relative to the unspiked concentration.*

As and Cd detected in baby foods

Figure 1 shows the measured results for total As and Cd in all 11 baby food samples in relation to the maximum action levels proposed in the Baby Food Act 2021. The concentration of Cd exceeded the proposed action level of 5 ppb for non-cereals in two baby foods. No Pb or Hg was detected in any of the food samples.

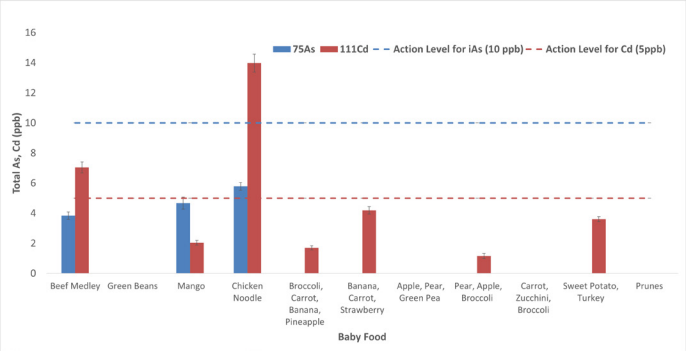

Figure 1. Measured concentrations of As and Cd compared to the proposed action levels (indicated by the blue and red dotted lines, respectively).

Inorganic arsenic by HPLC-ICP-MS

Figure 2 shows that all baby rice samples analyzed in a previous study by HPLC-ICP-MS would fail the action level for iAs proposed in the Baby Food Safety Act 2021 (orange-dotted line). Many of the samples would also fail the 100 ppb level for iAs in force in the EU and proposed by the FDA (green-dotted line).

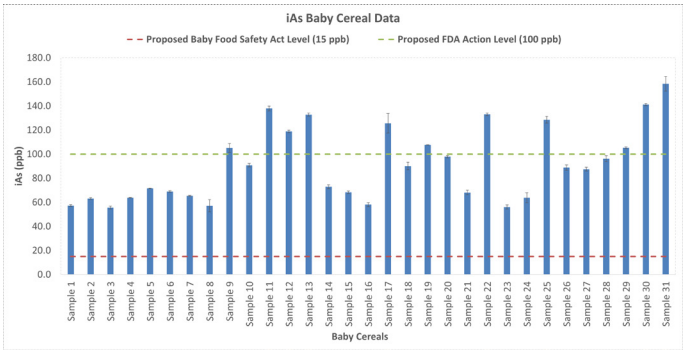

Figure 2. iAs in baby rice samples determined by HPLC-ICP-MS compared to proposed action level for iAs.

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