

# Characterization and Confirmation of Elemental Contents in Infant Formula Certified Reference Material of KRISS Using Multiple Analytical Methods

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Infant formula is often consumed as the major, or even sole source of, nutrients at particular growth stages of an infant. It contains various elements with essential functions as cofactors, but it may have hazardous elements from unwanted contamination. Considering that nutritional status of infants affects subsequent health and disease over an entire lifetime, it is important to provide correct information on nutrients and hazardous elements in foods and food supplements based on accurate measurements of their contents. For this purpose, it is essential to develop an appropriate CRM for the validation of analytical methods and the quality control of analytical results. In this study, KRISS has developed an infant formula CRM for elemental analysis. To certify the mass fractions of elements in infant formula, ID ICP-MS was used mostly except for monoisotopic elements, where gravimetric standard addition ICP-MS with internal standard was used. The certified and information values assigned were successfully confirmed using multiple analytical methods including standard comparator INAA,  $k_0$ -standardization INAA, and exact matrix-matching ICP-OES. Multiple results for most of elements showed good agreement within their specified uncertainties, which shows feasibility of these methods for certification of elements in complex matrix CRMs. But it also indicates that some elements require careful attention to identify the source of residual discrepancies.

Table. 1. The certified and information values assigned for elements in KRISS infant formula CRM.

Analyte	$w_x \pm U$	Analytical Method	Certified/Information
As	$0.1991 \pm 0.0072$	Standard addition ICP-MS	Certified value
Ca	$4904 \pm 63$	ID ICP-MS	Certified value
Cd	$0.07639 \pm 0.00076$	ID ICP-MS	Certified value
Cl	$3678 \pm 117$	ID ICP-MS	Certified value
Cu	$3.63 \pm 0.12$	ID ICP-MS	Certified value
Fe	$54.9 \pm 1.6$	ID ICP-MS	Certified value
K	$6084 \pm 76$	ID ICP-MS	Certified value
Mg	$582.7 \pm 8.1$	ID ICP-MS	Certified value
Se	$0.0905 \pm 0.0029$	ID ICP-MS	Certified value
Zn	$41.4 \pm 1.5$	ID ICP-MS	Certified value
I	$1.51 \pm 0.18$	Standard addition ICP-MS	Information value
Mn	$0.61 \pm 0.10$	ICP-OES	Information value (concensus)
Na	$1377 \pm 48$	ICP-OES	Information value (concensus)
P	$3280 \pm 140$	ICP-OES	Information value (concensus)



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