NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB 5009.268-2025

National food safety standard - Determination of multi-elements in foods

食品安全国家标准 食品中多元素的测定

Issued on: March 16, 2025 **Implemented on: September 16, 2025**

Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC

Table of Contents

1 Scope

GB 5009.268-2025 is the Chinese national food safety standard for the simultaneous determination of multiple elements in food. It is the workhorse method behind almost all metal contaminant enforcement in China: one digestion and one run give lead, cadmium, arsenic, mercury, chromium and the rest alongside the nutritional elements, which is why it underpins the limits in the contaminant standard and the nutrition labelling rules at the same time. The difficulty is that a single method must cope with matrices from drinking water to dried seaweed while holding detection limits at the microgram per kilogram level. The standard gives the inductively coupled plasma mass spectrometry method and the inductively coupled plasma optical emission spectrometry method, each with its principle, reagents and materials, instruments and equipment, analytical steps, expression of results, precision and additional notes, together with the detection and quantification limits for each element. It takes effect on 16 September 2025.

The Part I of this Standard specifies the inductively coupled plasma mass spectrometry and inductively coupled plasma emission spectrometry methods for the determination of multiple elements in foods; and the Part II specifies the inductively coupled plasma emission spectrometry method for the determination of multiple elements in nutritional fortifiers of compound foods. The Method I of the Part I is applicable to the determination of lithium, boron, sodium, magnesium, aluminum, phosphorus, sulfur, potassium, calcium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, arsenic, selenium, rubidium, strontium, molybdenum, cadmium, tin, antimony, barium, mercury, thallium and lead in foods; and the Method II of the Part I is applicable to the determination of aluminum, arsenic, boron, barium, calcium, cadmium, cobalt, chromium, copper, iron, potassium, magnesium, manganese, molybdenum, sodium, nickel, phosphorus, lead, sulfur, selenium, tin, strontium, titanium, vanadium and zinc in foods. The Part II is applicable to the determination of calcium, copper, iron, potassium, magnesium, manganese, sodium, phosphorus and zinc in nutritional fortifiers of compound foods with minerals as raw materials, with or without auxiliary materials. Part I Determination of Multi-Elements in Foods Method I Inductively Coupled Plasma Mass Spectrometry (ICP-MS)

2 Principle

After digestion, the specimen is measured by inductively coupled plasma mass spectrometry. The qualitative analysis is based on the specific mass number (mass-to-charge ratio, m/z) of the element; and the quantitative analysis is based on the intensity ratio of the mass spectrum signal of the element to be measured and the mass spectrum signal of the internal standard element, which is proportional to the concentration of the element to be measured.

3 Reagents and Materials

Unless otherwise specified, all reagents used in this Method are of guaranteed reagents; and water is Grade-1 water specified in GB/T 6682.

3.1 Reagents

3.1.1 Nitric acid (HNO_3).

3.1.2 Nitric acid with high purity (HNO_3). The content of the target element in the reagent is less than 1 μg/L. For trace detection, nitric acid with high purity should be used.

3.1.3 Argon (Ar). Argon (>=99.995%) or liquid argon.

3.1.4 Helium (He). Helium (>=99.995%).

3.1.5 L-cysteine hydrochloride monohydrate ($C_3H_{10}ClNO_3S$, CAS No.. 7048-04-6). >=98%, chromatographically pure.

3.1.6 Gold (Au) element solution. The mass concentration is 1,000 mg/L.

3.1.7 Isopropanol (C_3H_8O, CAS No.. 67-63-0). Chromatographically pure.

3.1.8 Hydrochloric acid (HCl).

3.2 Preparation of reagents Take 50 mL of nitric acid, slowly add it into 950 mL of water and mix well.

3.3 Standard solution

3.3.1 Single element standard stock solution (1,000 mg/L or 100 mg/L). lithium, boron, sodium, magnesium, aluminum, phosphorus, sulfur, potassium, calcium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, arsenic, selenium, rubidium, strontium, molybdenum, cadmium, tin, antimony, barium, thallium, lead. Use single element standard stock solution certified by the state and awarded with standard substance/standard sample certificate. Multi-element mixed standard stock solution can also be used.

3.3.2 Mercury standard stock solution (1,000 mg/L or 100 mg/L). Use single element standard stock solution certified by the state and awarded with standard substance/standard sample certificate. Standard series needs to be prepared separately.

3.3.3 Single element standard internal standard stock solution (1,000 mg/L). Single element standard stock solutions such as scandium, germanium, rhodium, indium, rhenium, bismuth, etc.; and multi-element mixed standard internal standard stock solutions can also be used. NOTE. When using single element standards to prepare mixed standard solutions and internal standard solutions, it is necessary to pay attention to the impurity content of the target element in the single element standard.

3.4 Preparation of standard solutions

3.4.1 Mixed standard solution. Take an appropriate amount of single element standard stock solution or multi-element mixed standard stock solution; dilute it step by step with nitric acid solution (5+95) to prepare a mixed standard solution series. For the preparation method and mass concentration of each element, see Tables A.1 and A.2.

3.4.2 Mercury standard solution. Take an appropriate amount of mercury standard stock solution; dilute it step by step with mercury standard diluent (A or B) to prepare a standard solution series. The mass concentration is shown in Table A.3.

3.4.3 Internal standard solution. Take an appropriate amount of single-element internal standard stock solution or multi-element mixed standard internal standard stock solution; and use nitric acid solution (5+95) to prepare an internal standard solution of appropriate concentration. The concentration of the internal standard solution is shown in A.2. NOTE. Isopropanol can be appropriately added to the internal standard solution to reduce the sensitization effect of elements such as arsenic and selenium caused by incomplete sample digestion (see Table A.4 for preparation method).

4 Instruments and Equipment

4.1 Inductively coupled plasma mass spectrometer (ICP-MS).

4.2 Balance. With sensitivity of

0.001 g.

4.3 Microwave digester.

4.4 Pressure digester.

4.5 Constant temperature drying oven.

4.6 Temperature-controlled electric heating plate or adjustable electric furnace.

4.7 Ultrasonic water bath.

4.8 Sample crushing equipment. homogenizer, high-speed crusher, etc.

5 Analysis Steps

5.1 Preparation of specimen NOTE. If there are requirements for preparation of specimen, refer to the relevant methods.

5.1.1 Solid samples

5.1.2 Liquid samples For specimens such as beverages and condiments, shake them