



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB 14883.9-2016

**National food safety standard - Determination of iodine-131, a
radioactive substance in foods**

食品安全国家标准 食品中放射性物质碘-131的测定

(English Translation)

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1 Scope

This standard applies to the determination of iodine-131 (^{131}I) in various foods.

Method 1 -- gamma-spectroscopy method

2 Principles

Contain the fresh food samples directly or pre-treated into a sample box of a certain shape and volume. On a gamma-spectrometer, measure the total-energy peak's net area of the gamma-ray characteristic peak of the ^{131}I at 364.5 keV in the sample. Compare it with the standard radioactive source of known activity.

Calculate the radioactivity concentration of ^{131}I . It is best to use gamma-spectroscopy method for the determination of ^{131}I in fresh-fission products within 6 days after fission; otherwise it shall carry out decay measurements, to exclude the interference from the short-lived iodine radioisotope.

3 Reagents and materials

^{137}Cs radioactive standard solution: The specific activity is about 1000 Bq/mL.

It has been calibrated by the national legal metrology department and has the inspection certificate as signed by the statutory recognized organization (it may also directly use the ^{131}I standard solution).

4.1.1 Detector: Coaxial high-purity helium or germanium (lithium) detector. The

energy resolution of the ^{60}Co 1332.5 keV gamma-ray total-energy peak is less than 3 keV, the relative efficiency is higher than 15%.

4.1.2 Shield: The main shield is a multi-layer material heavy metal shield whose equivalent lead equivalent is not less than 10 cm and atomic number of the

Respectively take 5 ~ 10 sample boxes of $\Phi 75\text{ mm} \times h 75\text{ mm}$. Respectively, add different volumes of distilled water and 2 mL of ^{137}Cs standard solution, to make the height within the range of 1 cm ~ 5 cm.

5.1.3 Eh' calibration of benchmark peak's efficiency

Measure the prepared standard source of ^{137}Cs aqueous solution of different heights. Use the formula (1) to calculate the detection efficiency Eh' of each at the 661.6 keV gamma-ray total-energy peaks:

Where:

Eh' - The detection efficiency of the standard source of ^{137}Cs aqueous solution of different heights at the total-energy peak of the 661.6 keV gamma-ray;

N - The net area of the total-energy peak of the 661.6 keV gamma-ray, n the unit of count;

A' - The activity of ^{137}Cs standard source, in the unit of Becquerel (Bq);

T' - The measurement time, in seconds (s);

B - The branch ratio of ^{137}Cs 661.6 keV gamma-ray, which is 84.62%.

Based on the above measured data, use the least squares method to fit out the relationship curve of Eh' -H.

5.2 Sampling

Sampling is carried out in accordance with the provisions of GB 14883.1.

5.3 Preparation of sample

5.3.1

Grain samples

Take 500 g of sample. Evenly spread it in an enamel pan or stainless-steel pan. Bake it in an oven at about 70 °C for about 5 h. Weight it. Calculate the dry-to-fresh ratio. After the granular grain is dried, it is directly placed in the sample box whose inside and outside had been cleaned; and compacted. The fine-powdered grain is compacted by a sample press, so that the sample's height is about 4 cm. Record the dry weight and height of the sample to be tested. Calculate the apparent density.

5.3.2

Vegetable samples

Take about 3 kg of sample. Remove the inedible part.

Wash it clean. Wipe off or dry the surface water drops. Chop it. Weigh the fresh weight. Spread it in an enamel pan or a stainless-steel pan. Bake it in an oven at about 70 °C until it is almost dry and soft. Weigh it. Calculate the dry-to-fresh

W - Amount of fresh sample corresponding to the measured sample, in kilograms (kg) or liters (L);

Eh - Benchmark peak's efficiency, which uses ^{137}Cs 661.6 keV energy peak as the reference peak, the value is found from the Eh'-H relationship curve which is drawn in accordance with 5.1.3;

R - Relative peak efficiency, which may use ^{137}Cs as the reference peak; it may also be obtained by test method (see 5.1.2 ~ 5.1.3); Use the ^{133}Ba standard solution which simulates ^{131}I to obtain the Eh-H relationship curve of the 356.0 keV gamma-ray, to calculate the ratio of the detection efficiency of the

356.0 keV peak and the 661.6 keV peak, which is the relative peak efficiency of ^{131}I ;

F - Total correction factor of measurement efficiency, %, as shown in

Appendix B. For more accurate calculation methods, please refer to GB/T

16145;

λ - The decay constant of ^{131}I , in units of hourly (h^{-1}), $\lambda = 0.693/T_0$, where T_0 is the half-life of ^{131}I , which takes 193 h;

t - The time interval between sampling and measurement, in hours (h).

7 Others

The calculation of the judgement limit and detection limit of this method may make reference to GB/T 16145.

Method 2 -- Radiochemical assay

8 Principles

The fresh sample of food is carbonized and ashed after being immersed in potassium carbonate solution. The water-leached liquid is extracted and separated by carbon tetrachloride and source-made in the form of silver iodide.

Use the low-background beta-meter to measure the beta-radioactivity concentration of ^{131}I .

9.1 Reagents

Calibration: Accurately pipette 1.00 mL of iodine carrier solution in a beaker which contains 20 mL of water. Heat it. Add a few drops of 2 mol/L nitric acid.

Immediately add 3 mL of 1% silver nitrate solution. Stir it. Heat it to make the settlements accumulate. Cool it down. Extract and filter the settlements on a quantitative filter paper which is placed in detachable funnel and has been constant-weighted. Use a small amount of anhydrous ethanol to rinse it. Dry it at 110 °C for 0.5 h. Weigh it to constant amount.

10 Instruments and equipment

10.1

Drying box.

10.2

Muffle furnace.

10.3

Conical separatory funnel

250 mL.

10.4

Detachable funnel

2 cm inner diameter.

10.5

Low-background beta-meter

The diameter of the tested sample is not less than 2 cm. The background is less than 1