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GCC STANDARDIZATION ORGANIZATION (GSO)

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طرق الكشف عن حدود المستويات الإشعاعية المسموح بها في المواد الغذائية
الجزء الأول :التحليل الطيفي لأشعة جاما أ-سيزيوم 134,سيزيوم 137

METHOD FOR DETECTION OF PERMISSIBLE RADIONUCLIDES LIMITS IN FOOD
PART 1: GAMMA SPECTROMETRY ANALYSIS
A ? Cs ? 134, Cs ? 137

ICS: 67.040

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METHOD FOR DETECTION OF PERMISSIBLE RADIONUCLIDES LIMITS IN FOOD
PART 1: GAMMA SPECTROMETRY ANALYSIS
A – Cs – 134, Cs – 137

1- SCOPE

This GSO standard is concerned with the detection of radionuclides in food by gamma ray spectrometry of Cs-134 and Cs-137.

2- COMPLEMENTARY REFERENCES

GSO 988/1998 "The Limits of Radioactivity Levels Permitted in Foodstuffs".

3- APPARATUS

Nal or high purity germanium gamma spectrometric system can be used.

3.1 **Nal gamma spectrometric system**

3.1.1 Tl activated Nal detector 7.62 x 7.62 cm including preamplifier, amplifier with gain, high voltage supply and with minimum reclusion 8%.

3.1.2 Personal computer (PC) with hardware needed for operation of the system.

3.1.3 Multichannel analyzer (MCA) suitable for PC (3.1.2) including software for food monitoring e.g. system calibration, peak search, net area determination ..... etc.

3.1.4 Printer and plotter compatible with the system (3.1.2).

3.1.5 Marinelli beakers 1 or 0.5 l.

3.1.6 Lead shielding (5 cm) to house the detector including preamplifier as well as Marinelli beaker.

3.1.7 Radionuclide standard sources:

Marinelli beaker (3.1.5) containing limited isotopes radionuclides and known activity, data of producing and volume and mass equal to the volume and mass of sample used for analysis.

3.2 **High purity germanium gamma spectrometric system**

3.2.1 High purity germanium detector with appropriate electronical and electrical equipment and with following specifications:

Efficiency (at 1.33 MeV): 20% min.

Resolution = 2.0 KeV.

Peak: Compton 45:1 or better.

Automatic high voltage shut down.

Appropriate cryistat for liquid nitrogen.

3.2.2 Apparatus mentioned in items 3.1.2 to 3.1.5.

3.2.3 Lead shielding (5 cm) with cooper and cadmium lining to house the detector, including preamplifier as well as Marinelli beaker.

3.2.4 Radionuclide standard sources:

Marinelli beaker (3.1.5) containing appropriate radionuclides cover up to 2000 KeV, known activity, date of production and volume and mass equal to the volume and mass of sample used for analysis

4- PREPARATION OF SAMPLE

Bone, nut and egg shells as part of sample shall be removed. Homogenize sample in blender or mach. homogenizer until it becomes a representative sample.

5- CALIBRATION

5.1 Energy calibration for MCA

The radionuclide standard sources is used to calibrate the channels. It is recommended to use at least three radionuclides one of them is Cs-137. An essential requirement for measurement of gamma emitters is to exact identity of photopeaks present in the spectrum. The channel number of MCA of each energy peal should be established and recorded. The system should be checked each day especially for Nal detector.

5.2 Efficiency calibration

It is essential that this calibration be performed with great care because all quantitative result will depend on it. It is also essential that all system setting and adjustment be made prior to determining the efficiencies and be maintained until a new calibration undertaken. Small changes in the setting of the system components may lead to wrong results.

A known activity radionuclide standard sources are used. The activity A of radionuclides should be determined at time of calibration as follows:

$$A = A\ e\text{-}^{2}\ t$$

Where:

A is certificated activity.

t is the time calculated form the date of certification.

λ is decay constant for each radionuclide = 0.693/ T½.

T½ Half-life of radionuclide.

5.2.1 **Efficiency calibration for Nal detector**

Place Marinelli beaker over the detector and count for appropriate time so that statistical error of counting is less than 1%. The efficiency calibration E of each radionuclide is calculated as follows:

$$E = \frac{R}{SP\ \lambda}$$