

CHAPTER 1

GENERAL INFORMATION

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## 1.1 SCOPE

Testing sunflower seed for oil content as "official criteria" is authorized under Section 7(b) of the United States Grain Standards Act (USGSA), as amended. All official sunflower seed oil analysis under the USGSA is performed in accordance with procedures prescribed in this handbook by authorized Federal Grain Inspection Service (FGIS) employees or licensed personnel employed by delegated/designated agencies.

The continuous wave and pulsed low resolution Nuclear Magnetic Resonance (NMR) instruments are the only approved instruments for official sunflower seed oil determination. The NMR method is based on the principle of activating hydrogen atoms in the oil using electromagnetic radiation and a magnet. The NMR reading is a measure of the number of activated hydrogen atoms. Technical Services Division (TSD) will use the petroleum ether oil extraction method (AOCS method number Ai 3-75) as a standard to which the NMR instruments are calibrated and referenced.

This handbook establishes procedures for officially determining and certificating oil content of sunflower seed, monitoring the accuracy of official sunflower seed oil results, and maintaining sunflower seed oil equipment accuracy.

## 1.2 DEFINITIONS

**Check Samples** - Sunflower seed samples tested by the Board of Appeals and Review and distributed to all specified service points for monitoring the uniformity of field results.

**Collaborative Study** - A study designed to compare NMR oil values determined by different laboratories.

**Constituent** - Compounds for which an analysis is made in a product, i.e., oil in sunflower seed.

**Continuous Wave NMR** - A technique used for determining the oil content of a sunflower seed sample by measuring the number of electromagnetically activated hydrogen atoms present in liquid oil. Continuous Wave (CW) instruments continuously apply external radio frequency energy to samples while simultaneously scanning the magnetic field. The signal is recorded by measuring the absorption of radiation by the nuclei at their resonant frequencies.

**Correlation** - The interdependency of one variable on another, i.e., the amount of oil extractable from a sample using petroleum ether and NMR response.

**Monitor Samples** - Sunflower seed samples randomly selected from the market which are analyzed and compared to a monitoring office.

**NMR Response** - A measure of the number of activated hydrogen atoms within a magnetic field.

**Oil** - A mixture of a glyceride ester of fatty acids widely occurring in organic tissues that are liquid at room temperature.

**Petroleum Ether Oil Extraction** - A chemical determination of percent oil in a sample.

**Pulsed NMR** - A technique used for determining the oil content of a sunflower seed sample by measuring the number of electromagnetically activated hydrogen atoms present in liquid oil. Pulsed NMR instruments apply external radio frequency energy to samples as short pulses lasting a few microseconds. The pulses simultaneously excite all of the nuclei in a sample and the signal (called a free induction decay) is measured after the pulse. All modern NMR instruments use pulsed techniques.

**Reference Value** - An oil value determined by TSD for each of the Sunflower Seed Standard samples and Sunflower Seed Check samples.

**Slope** - The degree of slant of the regression line.

**Specified Service Point** - A city, town, or other location specified by an agency for the performance of official inspection or Class X or Class Y weighing services.

**Sunflower Seed Standard (SSS)** - Dried and sealed sunflower seed samples with established weights and NMR oil values. SSS are prepared by TSD and distributed to specified service points to calibrate NMR instruments.

**Tuning Sample (TS)** - A sample (sunflower seed oil or relaxed mineral oil) giving a signal large enough to tune the NMR instrument.

### 1.3 RESPONSIBILITIES

The general responsibilities for the sunflower seed oil testing program are as follows:

- a. Responsibilities of the Technical Services Division.
  - (1) Maintain the standard reference petroleum ether oil extraction laboratory for FGIS and create calibrations for approved NMR instruments used for official NMR oil testing.
  - (2) Establish the official oil content of all Sunflower Seed Standards (SSS).
  - (3) Provide SSS to field offices and all service points providing official NMR sunflower seed oil determination.

- (4) Monitor the capability of the official sunflower seed oil testing program.
- (5) When necessary, review sunflower seed oil analysis procedures at FGIS field offices and specified service points.
- (6) Recommend corrective and follow-up action when problems are detected.
- (7) Provide technical support and training to official personnel in matters relating to oil analysis.
- (8) Initiate and/or conduct and report collaborative and/or special studies as needed.
- (9) When needed, perform calibration studies and make recommendations.
- (10) Provide Board appeal inspection for sunflower seed oil testing.
- (11) Issue certificates and assess fees for Board appeal inspection service.

b. Responsibilities of FGIS Field Office Managers.

- (1) Coordinate and maintain the sunflower seed NMR oil testing program within the circuit.
- (2) At domestic locations, perform or make arrangements to perform appeal inspections for sunflower seed oil testing services within the field office circuit.
- (3) At export locations, provide original, reinspection, and appeal sunflower seed oil testing services in areas not assigned to an official agency.
- (4) Forward file samples for Board appeal testing services to TSD.
- (5) Select and forward samples for monitoring to the Grand Forks Field Office. The Grand Forks Field Office will send their samples selected for monitoring to TSD.
- (6) Monitor the performance of specified service points within the circuit.
- (7) Review oil testing procedures at specified service points within the circuit.
- (8) Immediately inform TSD of problems detected in the circuit and initiate corrective and follow-up action.

- (9) Provide technical support and training to official inspection personnel.
- (10) Assist TSD in conducting collaborative and/or special studies.

c. Responsibilities of Official Agency Managers/State Cooperators.

- (1) Coordinate and maintain a sunflower seed oil testing program within the assigned geographic area.
- (2) Perform original and reinspection NMR sunflower seed oil testing services within the assigned geographic area and forward file samples for appeal sunflower seed oil testing services to the FGIS Grand Forks Field Office.
- (3) Select and forward samples for monitoring to the Grand Forks Field Office.
- (4) Routinely review oil analysis procedures at specified service points within the assigned geographic area.
- (5) Permit only official personnel who are trained and licensed for sunflower seed oil testing to perform such activities.
- (6) Provide technical support and training to licensed inspection personnel within the assigned geographic area.
- (7) Assist TSD and/or FGIS monitoring field office in conducting collaborative and/or special studies.
- (8) Inform the monitoring field office manager and TSD of problems detected within the assigned geographic area and initiate corrective and follow-up action.