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Fruit and Vegetable Programs

Processed Products Branch

Grading Manual for Peanut Butter

Effective April 2011

This manual is designed for Processed Products Branch personnel of the U.S. Department of Agriculture. Its purpose is to give background information and guidelines to assist in the uniform application and interpretation of U.S. grade standards, other similar specifications and special procedures.

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Peanut Butter
April 2011

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SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

Inspectors performing lot inspections should use the applicable procedures provided for on-line grading. In addition, for lot inspection of peanut butter, the following guidance applies:

1. Check the flavor and odor of a sample first, and then continue as shown for on-line grading (steps 1 through 6).

2. For consistency, allow sample to naturally cool to 70°F to 80°F (21°C to 27°C). Do not remove samples and cool artificially (e.g., in a cooler or water bath). Do not assign a final score for Consistency until samples have been permitted to equalize, a Minimum of 48 hours after packing.

Upon opening a container of peanut butter, carefully check the surface for the presence of free oil -- both in stabilized and nonstabilized types. Free oil in nonstabilized peanut butter is considered normal, but not in stabilized peanut butter.

NOTE THAT THE NATURAL GLOSS OF THE PRODUCT IS NOT CONSIDERED "FREE OIL".

For stabilized peanut butter, it has been administratively determined that any free oil that may be present in:

U.S. Grade A - cannot be poured off or collected, and does not flow when container is tilted.

U.S. Grade B - can be poured, and/or flows when the container is tilted, and/when collectable -- such collectable oil does not exceed 1 cubic centimeter (mL) per pound of product.

Check through the entire sample to be sure there are no pockets of oil below the surface. The bottoms of sample containers should also be checked for free oil or excessive dryness.

For non-stabilized peanut butter, slight to moderate mixing to disperse the separated oil should be possible in 30 to 35 seconds.

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE (continuation)

3. Sampling rates for Water Insoluble Inorganic Residues (WIIR), and light and heavy filth are in accordance with file codes 172-A-1 and 172-A-2.

4. Analyze each sample unit for salt content. Perform analysis using either Mohr Method or Conductivity (Salt Meter Method) in accordance with file code 135-A-19, Determination of Salt Content. Salt content is expressed as percent by weight. Use sample size specified in the instructions for each salt test method; if no sample size is specified, use a sample size of 5 grams.

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

1. **Evaluate** each sample unit for **flavor and odor.** Evaluate the flavor and odor quickly, as soon as the container is opened. The first impression is the best because the taste and smell sensations are quickly satisfied. Often, further flavor and odor evaluations of the sample fail to give reliable results. Good flavor is the result of properly roasted peanuts (neither under roasted nor over roasted) blended with the right proportion of additives (salt, sugar, honey, dextrose, etc.) for the particular type, style, and texture of peanut butter being produced. Good flavor in light brown, non-stabilized, medium texture "old fashioned" peanut butter cannot be used as a guide for evaluating the flavor of a dark brown, stabilized, smooth texture peanut butter containing all the permitted additives. The flavor should be evaluated based on the ideal for the particular style, type, and texture. The degree of roast has a great influence on flavor, odor and color. Peanut butter with good color could be expected to have better flavor than peanut butter with less than good color. The aroma of peanut butter should be that of freshly roasted and ground peanuts. The aroma must be free from musty, rancid, moldy, or any other objectionable odor. **Record** the flavor score after determining salt content, step 2, below.

2. **Analyze each sample unit for salt content. The salt content is required to assign a flavor score; analyze all sample units.** Perform analysis using either Mohr Method or Conductivity (Salt Meter Method) in accordance with file code 135-A-19, Determination of Salt Content. Salt content is expressed as percent by weight. Use sample size specified in the instructions for each method; if no sample size is specified, use a sample size of 5 grams.

3. **Analyze** the sample unit for **Water Insoluble Inorganic Residue (WIIR), Light Filth and Heavy Filth** by following the instructions in Technical Section of this manual. These tests are required to determine compliance with the U.S. Food and Drug Administration requirements (see File Codes 172-A-1 and 172-A-2). Products which fail these tests fail to meet the requirements of the Federal Food, Drug and Cosmetic Act and cannot be assigned a grade. Please contact your supervisor if this situation occurs. WIIR level is also a factor for determining U.S. grade.

   NOTE: ALSO SEE TEXTURE, pages 7 and 17.

   It is not practical to run a WIIR on every sample unit. If No. 1 peanuts are being used and the history of plant operations indicates WIIRs of less than 5 mg per 100 grams of product can be anticipated, one determination per eight

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT (continuation)

hour shift is sufficient. If WIIRs are running above 5 mg per 100 grams of product, perform one determination for every eight quality samples with a minimum of two per eight hour shift. If WIIRs are close to the upper limit, a WIIR should be run for every four quality samples, with a minimum of three per eight hour shift. See pages 11 through 15 of this manual for the procedures for running WIIR. Light filth and heavy filth are run on the residue and the decanted material obtained in the BASIC STEPS of the WIIR determination. See pages 13 through 17 of this manual for the procedure for running light filth or heavy filth. The sampling rates for light filth and heavy filth are specified in File Code 172-A-1.

4. **Evaluate** the **color** of each sample unit. With a spatula, place a smear of peanut butter (about 1/2 inch wide and about 2 inches long) on white paper. Spread the smear to about the area and depth of the peanut butter color standards. A wide spatula, with a groove the correct width and depth, is an invaluable aid for getting the peanut butter smear to the correct size and depth for evaluating its color using the plastic color comparators. With a small spatula, remove the sheen from the top of the prepared sample. Select the two color standards that most closely match the color of the peanut butter. Place the color standards on each side of the prepared sample and, using the Macbeth Examolite or other approved lighting source, **classify** and **record** the color designation and **assign** score points for the factor of color. Information for obtaining color standards for peanut butter is available at: http://www.ams.usda.gov/processedinspection.

5. **Evaluate** each sample unit for **dark particles using** Inspection Aid No. 95. Follow the instructions included on the aid and **evaluate** the sample for defects by comparing the sample unit with Photo-Guides for Peanut Butter Illustrating Dark Particles in Peanut Butter, PG-4. Record the score for the factor of defects. Information for obtaining PG-4 for peanut butter is available at: http://www.ams.usda.gov/processedinspection.

6. **Determine** the **texture** of each sample unit. Generally texture can be determined by spreading a subsample on a grading tray, and observing the size of the peanut particles. In borderline situations the texture should be determined as outlined on page 16 of this manual.

7. **Evaluate** the sample unit for **consistency.** Consistency refers to the spreadability of the product and to the amount of oil separation in either stabilized or nonstabilized type peanut butter. Peanut butter should set

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT (continuation)

undisturbed after packaging and palletizing and reach an internal temperature between 70°F and 80°F (21°C and 27°C) before consistency is evaluated. Allow sample to **naturally** cool to 70°F to 80°F (21°C to 27°C). Do not cool artificially (e.g., in a cooler or water bath). Do not assign a final score for consistency until samples have been permitted to equalize, a minimum of 48 hours after packing. (Unless otherwise specified by the contract or purchase order.)

Upon opening a container of peanut butter, carefully check the surface for the presence of free oil -- both in stabilized and nonstabilized types. A slight amount of free oil in nonstabilized peanut butter is considered normal, but not in stabilized peanut butter.

THE NATURAL GLOSS OF THE PRODUCT IS NOT CONSIDERED "FREE OIL".

For stabilized peanut butter, it has been administratively determined that any free oil that may be present in:

U.S. Grade A - cannot be poured off or collected, and does not flow when container is tilted.

U.S. Grade B - can be poured, and/or flows when the container is tilted, and/when collectable -- such collectable oil does not exceed 1 cubic centimeter (mL) per pound of product.

Check through the entire sample to be sure there are no pockets of oil below the surface. The bottoms of sample containers should also be checked for free oil or excessive dryness.

For non-stabilized peanut butter, slight to moderate mixing to disperse the separated oil should be possible in 30 to 35 seconds.

Peanut butter must not be abnormally sticky in U.S. Grade A. Excessive stickiness can be caused by: incorrect setting for the fineness of grind, improper cooling time, or by altering the percentages of added ingredients.

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT (continuation)

Noting that peanut butter is used primarily as a spread for bread, the consistency for U.S. Grade A should be such that it spreads easily on fresh bread (having a moderately dense crumb) without appreciable tearing or breaking of the bread.

Consistency may be checked by drawing the flat side of a table knife (blade about 3/4 inches wide) through the peanut butter. The blade should be inserted approximately 2-1/2 inches into the peanut butter and held at an approximate 45° angle. If there is more than a slight resistance to drawing the knife through the peanut butter or the product is so thin that the path collapses within about 3 seconds, the peanut butter should not be graded above U.S. Grade B.

Peanut butter may also lack U.S. Grade A consistency because it hasn't set properly. Product with a gelatin like consistency is the result of a poor set. This may not be evident upon opening the container but can develop a short time after the surface of the product is disturbed. After the sample unit has been opened:

a. Perform a 45° angle cut through the product.

b. On samples that are borderline "Soft" or "Thin," proceed as follows:

1. Using a table knife, remove portions of the product from the container. (Follow normal procedure in spreading product on 5-6 slices of bread.)

2. Perform another 45° angle cut through the product. If the product has developed a gelatin like condition that is more than slightly noticeable or if the knife path collapses within about 3 seconds, the peanut butter should not be graded above U.S. Grade B.

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT (continuation)

SPECIAL ON-LINE SITUATIONS

Government Contracts.

In addition to the grade determination, the inspector checks other requirements (such as markings, coding) when Government contracts are being run. Review the terms of the contract and specifications for any special requirements and verify these requirements with your supervisor. Follow instructions in File Codes 147-A-22, Inspection of FSA Peanut and Peanut Products, and 172-A-3 for submission of samples for aflatoxin testing. The Branch may implement review programs to ensure uniform application of procedures and delivery of compliant product to applicants.

TECHNICAL SECTION

This section describes technical procedures for performing:

Water Insoluble Inorganic Residue (WIIR);
Light Filth;
Heavy Filth; and
Texture (used in borderline cases.)

It is Branch policy to perform these tests to confirm that peanut butter graded by the Branch does not exceed FDA Defect Action Levels (DALs). (See File Codes 172-A-1 and 172-A-2.) Products which fail these tests fail to meet the requirements of the Federal Food, Drug and Cosmetic Act and cannot be assigned a grade. Please contact your supervisor if this situation occurs. Note that WIIR level is also a factor for determining U.S. grade. The U.S. Standards for Grades of Peanut Butter indicate these tests are performed in accordance with the latest official methods outlined in the Official Methods of Analysis of the Association of the Official Analytical Chemists (AOAC) or any other method that gives equivalent results.

The Light and Heavy Filth Test Methods in this Manual may be used for determining light and heavy filth in peanut butter. Light filth and heavy filth are run on the residue and the decanted material obtained in the BASIC STEPS of the WIIR.

AOAC Method 968.35, section B may also be used to obtain material for running light and heavy filth.

Alternatively, samples for WIIR and Light and Heavy Filth determination may be sent to designated field offices for analysis.

Since corrosive, explosive, and/or cumulatively toxic chemicals are used in the following procedures, follow current Branch instructions for laboratory safety. All analyses should be conducted under a suitable laboratory fume hood. Uncontrolled open flames shall not be permitted.

NOTE: THESE PROCEDURES MAY BE USED IN APPROVED, PROPERLY EQUIPPED LABORATORIES **ONLY**. IF IN DOUBT CONSULT YOUR SUPERVISOR.

TECHNICAL SECTION (continuation)

1. **List of Equipment**

Balance, triple beam, with 0.1 g precision.
Balance, analytical, with 0.1 mg precision.
Boiling Chips
Beakers, Griffin, low form plastic or Pyrex - 250 mL, 600 mL
Bottles, wash - 250 mL polyethylene
Brush, camel's hair
Burner, Bunsen
Burettes, 100 mL capacity, with 0.1 mL precision.
Crucibles, Platinum or silica
Cylinder, graduated, 100 mL graduated in 0.5 mL
Dish, platinum or silica
Flask, Erlenmeyer, w/rubber stopper - 250 mL, 500 mL, 2 L
Flask, vacuum - 500 mL or 1000 mL
Funnel, Buchner, 15 cm
Funnel 60°, short stem, 4 or 5 inch diameter
Furnace, muffle - 0° to 500° C
Glass, watch - 3 or 4 inch diameter
Microscope, wide field - 20X and 30X
Paper, rapid filter - ashless 15 cm
pH meter
Pump, acid, calibrated to 0.1 mL
Rods, stirring, plastic (or glass w/policeman)
Sieves, U.S. Standard 20, 30, and 40 mesh, fine series, 8 inch
Thermometer, 0° to 100°C
Vacuum source
Water bath
Wildman trapflask

2. **List of Chemicals (Unless noted, all chemicals should be reagent grade.)**

Acid, Hydrochloric, HCl
Chloroform, $CHCl_3$
Ether, petroleum
Formaldehyde, HCOH
Kerosene, commercial
Pancreatin, Merck, U.S.P. (keep refrigerated at 10°C or 50°F)
Sodium phosphate, tribasic, $Na_3PO_4.12H_2O$ (5%)

TECHNICAL SECTION (continuation)

3. **Preparation of Pancreatin Extract (for Light Filth)**

a. Standard Procedure

i. Mix 5 grams of pancreatin with 100 mL of warm water (not over 40°C or 104°F) for 10 minutes in a blender, or allow to stand for 30 minutes with intermittent stirring.
ii. Filter solution through 4 inches of loosely packed cotton in a 60° funnel.
iii. Repeat filtering, using the same cotton. (If filtering is very slow, cotton may be changed.)
iv. Filter with suction through a fast filter paper in a Buchner funnel.

NOTE: IF FILTERING IS SLOW, POUR THROUGH A SLIGHTLY COMPRESSED COTTON PLUG IN A 60° FUNNEL. REPEAT IF NECESSARY UNTIL RAPID FILTRATION THROUGH PAPER IS OBTAINED.

b. Alternate Procedure
Mix 10 grams of pancreatin with 100 mL of warm water, allow to stand for 2-1/2 hours and proceed as indicated for the standard pancreatin extract.

4. **WATER INSOLUBLE INORGANIC RESIDUE (WIIR), LIGHT FILTH, HEAVY FILTH, TEXTURE**

NOTE: CHLORIDE FREE, DISTILLED WATER (ONLY) SHOULD BE USED IN THESE ANALYSES.

METHODS OF ANALYSIS

a. Basic steps - WIIR, Light Filth, Heavy Filth, Texture

Steps 1 through 19 are common to the WIIR, light filth, heavy filth, and texture.

NOTE: STEP 12: THE DECANTED PETROLEUM ETHER FROM THE PREVIOUS STEPS IS TO BE DISCARDED.

TECHNICAL SECTION (continuation)

(1) Weigh 100 grams of subsample into a tared 250 mL beaker.
(2) Add 10 mL of petroleum ether and mix **thoroughly.**
(3) Gradually add approximately 140 mL of petroleum ether, mixing continually.
(4) Cover and allow to settle for 25 minutes.
(5) Float off light tissue by **carefully** decanting about 100 mL of the petroleum ether layer.
(6) Add approximately 125 mL of petroleum ether to the residue in the beaker, washing down the sides of the beaker with a stream of petroleum ether from the **wash bottle**, mix **thoroughly**.
(7) Cover and let settle for 15 minutes.
(8) Float off light tissue by **carefully** decanting about 100 mL of the petroleum ether layer.
(9) Add approximately 125 mL of petroleum ether to the residue, washing down the sides of the beaker with a stream of petroleum ether from the **wash bottle**, mix **thoroughly**.
(10) Cover and allow to settle for 10 minutes.
(11) Float off light tissue by carefully decanting about 100 mL of the petroleum ether layer.
(12) Discard all decanted petroleum ether, saving only the residue remaining in the beaker.
(13) Evaporate the remaining petroleum ether from the residue in the beaker using a water bath. (The evaporation may be accomplished in a fume hood by allowing the air flow to pass over the residue in the beaker).
(14) Add 100 mL of chloroform ($CHCl_3$), washing down the sides of the beaker with a stream of chloroform from the wash bottle, mix **thoroughly.**
(15) Cover and allow to settle for 20 minutes, stirring the **top** layer several times while settling to dislodge any heavy filth trapped in the crust.
(16) Without disturbing the heavy residue at the bottom of the beaker - decant the $CHCl_3$ and the floating peanut tissue into a clean beaker and **SAVE.**
(17) Repeat steps 14, 15, and 16 using $CHCl_3$.
(18) Repeat steps 14, 15, and 16 making sure all particles are washed from the sides of the beaker.
(19) Save all decanted peanut tissue for later light filth or texture determination.

All of the residue in the beaker is used for the determination of heavy filth and WIIR.

TECHNICAL SECTION (continuation)

(20) **Heavy filth** - Examine the residue in the beaker (from step 19 of the basic steps) for obvious contamination by sand, rodent excreta, or other heavy filth.

b. WIIR

METHOD I

(1) Wash the heavy residue from step 18, above, thoroughly several times with hot water. Carefully decant the hot water and discard.

(2) Dry the residue in the beaker on a hot plate or by standing in air.

(3) Transfer the dried residue to a tared crucible with the aid of a camel's hair brush.

(4) Ignite the residue and dry in a muffle furnace at 500°C - 550°C. (932°F - 1022°F) for one hour.

(5) Weigh to the nearest 0.1 mg (0.0001 g) and round to nearest mg (0.001 g).

METHOD II

(1) Add 50 mL of dilute HCl (1+35) to the heavy residue in the beaker from step 18. Add 90 mL hot water, stir thoroughly and allow to stand 30 minutes.

NOTE: ONE PART HCl TO 35 PARTS WATER.

(2) With the aid of a stream of hot water transfer the residue from the beaker to an ashless filter paper using a Buchner funnel and a vacuum source.

(3) Wash the filter paper **thoroughly** with **hot water** to ensure water soluble residue is dissolved.

(4) Transfer the filter paper to a tared crucible.

(5) Ignite the filter paper and dry in a muffle furnace at 500°C - 550°C. (932°F - 1022°F) for one hour.

(6) Weigh to the nearest 0.1 mg (0.0001 g) and round to nearest mg (0.001 g).

TECHNICAL SECTION (continuation)

c. LIGHT FILTH - Light filth is run on the decanted peanut tissue from steps14 through 18 of the basic steps.

NOTE: ALL TEMPERATURES STARTING WITH STEP 4 IN THIS PROCEDURE ARE OF A CRITICAL NATURE. SUFFICIENT MARGINS HAVE BEEN ALLOWED FOR MINOR FLUCTUATIONS. IF TEMPERATURE EXCEEDS 40°C (104°F) AT ANY POINT, DISCARD AND START OVER.

(1) Filter the decanted peanut tissue (from step 19 of the basic steps) through a rapid filter paper.

(2) Transfer all collected residue to a hard surface paper. Save the filter paper for later washing.

(3) Break up any caked or lumpy peanut material and dry. [Overnight at room temperature or for 1 hour in an oven at 80°C (176°F.)]

(4) Transfer the dry residue to a 600 mL beaker.

(5) Rinse the filter paper (saved from step 2) with cold water and add the washings to the beaker.

(6) Add 300 - 400 mL of cold water and stir until smooth.

(7) Add freshly prepared, filtered, aqueous pancreatin extract and mix. (Total volume of extract (approximately 100 mL) prepared as shown on page 12 is required for this step.)

(8) Adjust to pH 8.0 with Na_3PO_4 solution (5%), and set aside for 15 minutes.

(9) Re-adjust to pH 8.0 and set aside for 45 minutes.

(10) Re-adjust to pH 8.0 and proceed.

(11) Add 5 drops of formaldehyde, U.S.P.

(12) Allow mixture to “digest” for 16 to 18 hours in a warm oven 30°C - 37°C (86°F - 99°F).

TECHNICAL SECTION (continuation)

NOTE: DIGESTION MAY BE ACCOMPLISHED IN 2 1/2 HOURS BY USING THE ALTERNATE PANCREATIN EXTRACT ON PAGE 12 AND DIGESTING AT 37° - 39°C (99°F - 102°F).

(13) Cool to room temperature and transfer the digested material to a 2 liter Wildman trapflask.

(14) Add sufficient deaerated water to bring the volume to 800 or 900 mL.

(15) Add 35 mL of kerosene, agitate vigorously without breaking the surface or incorporating air into the mixture.

(16) Add sufficient deaerated water to raise the kerosene level into the neck of the flask.

(17) Allow to stand for 30 minutes.

(18) Trap off the kerosene into a beaker.

(19) Add 25 mL of kerosene to the flask, agitate vigorously without breaking the surface or incorporating air into the product. Allow to stand for 10 minutes.

(20) Trap off the kerosene layer into the beaker used in the step 18.

(21) Filter the kerosene fraction through a ruled, fast filter paper.

(22) Examine microscopically using a wide field microscope at 20X for scanning and at 30X for identification of light filth.

d. **SALT**

Salt in peanut butter is determined in accordance with the latest method in the Official Methods of Analysis of the Association of Analytical Communities (AOAC) International, or either the Mohr Method or Conductivity (Salt Meter Method) in accordance with File Code 135-A-19, or any other method approved by the Branch that gives equivalent results.

e. **TEXTURE**

This procedure should be used when there is a question about the texture of

TECHNICAL SECTION (continuation)

a sample. (Borderline situation).

(1) Pour all of the decanted material from steps 14, 15, 16, 17, and 18 of the basic steps through a nest of sieves, having as U.S. number 20 on top, a U.S. number 30 in the middle, and a U.S. number 40 on the bottom.

(2) Allow to dry in the open air for 5 to 10 minutes.

(3) Shake moderately, allowing the dry peanut residue to pass through the sieves.

Classify the texture using the following guidelines.

Smooth texture -	All the dried peanut residue passes through the U.S. number 20 sieve. Not more than one half gram is retained on the U.S. number 30 sieve.
Medium texture -	More than one half gram of the dried peanut residue is retained on the U.S. number 30 sieve, with not more than one half gram being retained on the U.S. number 20 sieve.
Chunky or - Crunchy texture	More than one half gram of the dried peanut residue is retained on the U.S. number 20 sieve.