# Macroanalytical Procedures Manual (MPM)

# V-5. Miscellaneous Food Products, Especially Plant Gums

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## A. Method for Plant Gums (V-24)

### (1) Scope

This method describes procedures for detecting and measuring contamination caused by extraneous material and/or decomposition in plant gums and for determining the percent of reject product material due to insect damage, mold, or other adhering filth. The method involves direct visual examination and separation of contaminants.

Gums are hydrocolloids (hydrophilic colloids). Their water-binding properties make them an important ingredient for improving the texture of foods. The method is applicable, but not limited to, the "natural" gums listed in Table V-5-A-4.

## (2) Applicable Documents

None

## (3) Defects

Plant gums are subject to contamination by field and storage insects, birds, rodents, other animals, and foreign material. Mold growth can also result from improper drying or storage conditions.

**Arthropods**:

Many natural gums are subject to field pests specific to the parent plant. Table V-5-A-1 list some field pests; this is not an all-inclusive list.

Table V-5-A-1 Field pests of natural gums

| Natural Gum | Scientific Name | Common Name |
|---|---|---|
| Arabic gum | *Sternocera castanea* (Oliver) | - |
| Guar gum | *Contarinia texana* (Felt) | guar midge |
| Locust bean | *Ectomyelois ceratoniae* (Zeller) | carob moth |
| Larch gum | *Dendroctonus simplex* LeConte | Eastern larch beetle |

Natural gums are subject to infestation of storage pests of all kinds with one specific product/pest relationship:

*Hofmannophila pseudospretella* (Stainton), brown house moth-has been found to damage Furcellaran, *Furcellaria* sp. J.V.Lamouroux (Hill 2002).

## (4) Procedure: Determination of Contamination in Plant Gums Caused by Insects, Animal Excreta and Extraneous Material

a. ***Sample Preparation*** -- Sample a representative or selective number of analytical units of the product, depending on the history of the lot. At a minimum, collect 6 subsamples, each with a minimum of 454g. Weigh each analytical unit or subsample separately. Where appropriate sift a minimum of 100 g from each subsample or analytical unit on appropriate size sieve(s) to separate whole insects, rodent excreta, and other extraneous material. Select sieve size according to form and/or particle size of product, and type and size of filth elements you are trying to isolate. State sieve size and method of use in report of results.

b. ***Visual Examination and Report*** -- Examine suitable subsample size as below, inspecting "throughs" and "overs" on the sieve(s), if used. Analyze 6 subsamples, a minimum of 100 g each. Examine the product in small amounts with good light and against a white or other suitable contrasting background. A moving belt or other mechanical device may be used if all the material can be seen easily. Sieving may facilitate separation and concentration of certain types of extraneous materials. Examine macroscopically for rodent excreta, dung, insects, and insect debris, mold clumps, miscellaneous extraneous materials, and other evidence of contamination.

c. ***Classification of Contaminants*** – Separate contaminants into suitable groupings. Add categories to tabulation of results depending on type(s) of contaminants found. Classify as follows:

**(i) *Insects*** -- Count number of whole or equivalent insects visible to the naked eye (Figure V-5-A-1) (corrected as necessary for abnormal vision) with such magnification as may be necessary. If the magnification exceeds 10X, this should be stated in the report of results. Identify insects to the lowest taxonomic level possible, using appropriate insect identification keys. Making a special notation when they are found alive. Note the size and life stage(s) found.


**Figure V-5-A-1** *Stegobium paniceum* (L.), drug store beetle in psyllium husk powder. (Source Photo courtesy of H. Loechelt-Yoshioka, FDA).

**(ii) *Rodent (Rat or Mouse) Excreta*** -- Rodent excreta pellets are normally black or dark colored, roughly cylindrical, blunt at one end and pointed at the other (V-5-A-2). They range in length from 1.5 to 15 mm. They usually contain rat or mouse hairs, partially digested plant material and sometimes insect parts, and when wetted with water, rodent pellets form a characteristic gray mucous coating. Measure length and weigh suspect pellets before

wetting and report as such *only* if rat or mouse hairs are present. Confirm identification by removing a hair from the pellet and identifying it microscopically. When no hairs are present, proceed by following (AOAC Official Method 981.22 Mammalian Feces Alkaline Phosphatase Test) Note: powdered gums can clump in the presence of rodent urine and other liquids.

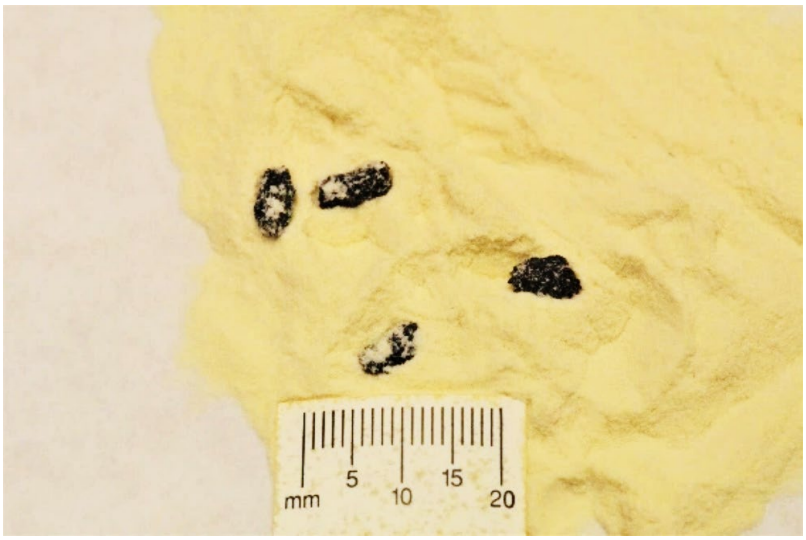


**Figure V-5-A-2** Rat, *Rattus* sp., Fischer, excreta pellets in xanthan gum (Source: Photo courtesy of H. Loechelt-Yoshioka, FDA)

**(iii)** ***Animal Dung*** -- Animal dung consists of an amorphous, usually dark colored material pressed into a matrix. Incorporated plant material usually consists of ligneous, fibrous material which is either pale-yellow or green. Parts of insects and small amounts of inorganic, earthy material may also be present. Weigh suspect material and report as animal dung or excreta, *only* when matricized plant material predominates. Confirm as excreta by following (AOAC Official Method 988.17 Feces Mammalian: Thin-Layer Chromatographic Method for Coprostanol).

**(iv)** ***Bird Excreta*** -- Bird excreta will appear as rounded droppings, sometimes coiled with a white residue. Weigh droppings and test a portion of the white, amorphous particles for uric acid by following the flow chart in (AOAC Official Method 962.20 Excrement (Bird) on Food and Containers Microchemical Test for Uric Acid).

***(v) Extraneous Material*** – is any foreign material in a product associated with objectionable conditions and practices in production, storage, or distribution. In addition to substances (i) to (iv) above, this includes but not limited to sand, glass, rust, plastic, sticks, etc.

***d. Report*** -- Tabulate results as follows, adding additional categories as necessary (Table V-5-A-2):

Table V-5-A-2 Recommended format for reporting results.

| | Subsample No. | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | etc. |
| Weight Examined (g) | | | | |
| Whole Insects or Equivalent (by count) [a] | | | | |
| Excreta (mg/kg) [b] | | | | |
| Animal Dung [c] (% by wt.) | | | | |
| Bird Excreta [d] (% by wt.) | | | | |
| Extraneous Material (by count) [e] | | | | |
| Remarks: | | | | |

Notes:
a. Describe ((4)c.(i)); report under Remarks
b. Describe ((4)c.(ii)); report under Remarks
c. Describe ((4)c.(iii)): report under Remarks
d. Describe ((4)c.(iv)): report under Remarks
e. Describe ((4)c.(v)): report under Remarks

## (5) Procedure: Determination of Insect-Damaged, Moldy, and Otherwise Reject Product Material in Plant Gums

a. ***Sample Preparation*** From each subsample weigh a minimum of 100 g of material remaining from Procedure (4(a)) as the analytical unit. Depending on the size of gum pieces, the sieve "overs" may provide this analytical unit. Alternatively, draw a separate analytical unit of a minimum of 100 g from the original subsample. State how analytical unit is taken.

b. ***Visual Examination and Report*** -- Examine each product piece in the analytical unit for reject material visible to the naked eye. Magnification may be used for confirmation, as necessary. If the magnification exceeds 10X, this should be stated in the report of results. Classify, weigh, or count each category according to (5)c below.

c. ***Classification of Reject Product Material*** – Classify and weigh reject product material as follows:

**(i)** ***Insect-Damaged*** -- Any product material exhibiting definite evidence of insect feeding or containing one or more whole insects or equivalent, webbing, or excreta. Making special notation for live insects. Determine average length and note range of lengths for any larvae and/or unidentified insects present.

**(ii) *Moldy*** -- Any product material bearing mold on more than 1/4 of its surface area or any material where the aggregate moldy area is greater than 1 $cm^2$. Confirm presence of mold/yeast with magnification as necessary, making a slide mount with lactophenol cotton blue (Leck 1999), (see also sec. III. Reagents for Macroanalytical Methods) to differentiate between yeast and mold can be useful. Confirm findings by the presence of mold hyphae and/or spore forming structures that are visible to the unaided eye. Microscopic examination may be used to confirm the presence of characteristic hyphal filaments and fruiting structures.

**(iii) *Animal-Contaminated*** -- Any product material showing animal excreta, animal chewing, or gnawing. Confirm identification of animal excreta.

**(iv) *Otherwise Reject Material*** -- Any product material that is not classified as above, but is decomposed, discolored, abnormal in appearance or otherwise unfit for food.

***d. Report*** - Tabulate results as follows, adding additional categories as necessary (Table V-5-A-3):

Table V-5-A-3 Recommended format for reporting results.

| | Subsample No. | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | etc. |
| Amount Examined (Wt. in g) | | | | |
| Insect-Damaged [a] (Wt. in g) % | | | | |
| Moldy [b] (Wt. in g) % | | | | |
| Animal Contamination [c] (Wt. in g) % | | | | |
| Otherwise, unfit [d] (Wt. in g) % | | | | |
| Total Percent of Reject | | | | |
| Remarks: | | | | |
| | | | | |

Notes:
a. Describe ((5)c.(i)); report under Remarks
b. Describe ((5)c.(ii)); report under Remarks
c. Describe ((5)c.(iii)); report under Remarks
d. Describe ((5)c.(iv)); report under Remarks

# References Cited in Section:

Hill, D. S. (2002). Pests of Stored Foodstuffs and Their Control. Springer Publishing.

Leck, A. (1999). Preparation of Lactophenol Cotton Blue Slide Mounts. *Community Eye Health 12(30), 24-24.* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1706009/pdf/jceh_12_30_024.3.pdf

Official Method 962.20 Excrement (Bird) on Food and Containers Microchemical Test for Uric Acid. *Official Methods of Analysis of AOAC INTERNATIONAL,* Chapter 16.

Official Method 970.66B(i) Light and Heavy Filth General. *Official Methods of Analysis of AOAC INTERNATIONAL,* Chapter 16.

Official Method 981.22 Mammalian Feces Alkaline Phosphatase Test. *Official Methods of Analysis of AOAC INTERNATIONAL,* Chapter 16.

Official Method 988.17 Feces Mammalian: Thin-Layer Chromatographic Method for Coprostanol. *Official Methods of Analysis of AOAC INTERNATIONAL,* Chapter 16.

# Additional Information:

Informational articles not cited in the above section, but still useful:

CFSAN Constituent Updates (2021). *FDA Grants Citizen Petition on Acacia (Gum Arabic) as a Dietary Fiber. https://www.fda.gov/food/cfsan-constituent-updates/fda-grants-citizen-petition-acacia-gum-arabic-dietary-fiber.*

Official Method 969.45 Light Filth in Crude Plant Gums, *Official Methods of Analysis of AOAC INTERNATIONAL*, Chapter 16.

## Table V-5-A-4 Natural gums covered by the gum method. *

| Type | Name of Gum | Plant source | Scientific name | Production Area |
|---|---|---|---|---|
| Plant Exudates | Arabic | acacia tree | *Acacia sp.* A. Chevallier | Africa |
| | Chios Gum or Mastic | mastic tree gum | *Pistsacia lentiscus* L. | Mediterranean |
| | Frankincense | frankincense | *Boswellia* sp. Roxburgh ex Colebrooke | Africa |
| | Ghatti | axlewood tree | *Anogeissus latifolia* (Roxburgh ex. de Candolle) Wallich ex Guillemin & Perrottet | India and Ceylon |
| | Karaya | gum karaya tree | *Sterculia urens* Roxburgh | India |
| | Peach Gum or Peach Tree Tears | peach tree | *Prunus persica* (L.) Batsch | Asia |
| | Tragacanth | milkvetch shrub | *Astragalus sp.* L. | Asia Minor, Iran, Syria, Turkey |
| Plant Extracts | Arabinoga-lactan (larch gum) | larch tree | *Larix* sp. Miller | United States |
| | Pectins | citrus peel and apple pomace | Various *Citrus* spp. L. *Malus sylvestris* (L.) Miller | United States |
| Plant Seed/corm Flours | Guar | guar or cluster bean | *Cyamopsis tertragonoloba* (L.) Taubert | India and Pakistan |
| | Konjac | devil's tongue | *Amorphophallus konjac* K. Koch | Asia |
| | Locust bean (carob bean) | carob tree | *Ceratonia siliqua* L. | Near East and Mediterranean |
| | Psyllium Seed | blond plantain seeds | *Plantago ovata* Forsskål | India and Mediterranean |
| | Quince Seed | quince tree | *Cydonia oblonga* Miller | Iran |
| Seaweed Extracts | Agar | red algae | *Gelidium* sp. J.V. Lamouroux | Japan |
| | Alginates | brown algae (kelp) | *Macrocystis pyrifera* (L.) C.A. Agardh. | United States |
| | Carrageenan | red algae | *Chondrus* sp. Stackhouse *Gigartina* sp. Stackhouse | Maine and Europe |
| | Furcellaran | red algae | *Furcellaria fastigiate* (Hudson) Lamouroux | Denmark and Norway |

*List of gums are not all inclusive.

# Revision History

| Version No. | Purpose of change | Date |
|---|---|---|
| V0 | New process | 1984 |
| V1 | Electronic version | 1998 |
| V2 | Edited for clarity and readability. Added examples of field and storage pests. Added Chios gum, frankincense, konjac, and peach gum to Natural Gum table. Added guidelines for examination, classification, and reporting of filth elements and reject material. Added images. | 2024 |