

Neutral Detergent Fiber in Feeds

Filter Bag Technique

(ANKOM²⁰⁰⁰)

DEFINITION

This method determines Neutral Detergent Fiber, which is the residue remaining after digesting in a detergent solution. The fiber residues are predominantly hemicelluloses, cellulose, and lignin.

SCOPE

This method is applicable to grains, feeds, forages and all fiber-bearing material.

APPARATUS

1. Analytical Balance—capable of weighing down to 0.1 mg.
2. Oven—capable of maintaining a temperature of $102\pm 2^{\circ}\text{C}$.
3. Digestion instrument—capable of performing the digestion at $100\pm 0.5^{\circ}\text{C}$ and maintaining a pressure of 10-25 psi. The instrument must also be capable of creating a similar flow around each sample to ensure uniformity of extraction (ANKOM²⁰⁰⁰ w/65 rpm agitation, ANKOM Technology).
4. Filter bags—constructed from chemically inert and heat resistant filter media, capable of being heat sealed closed and able to retain 25 micron particles while permitting rapid solution penetration (F57, ANKOM Technology).
5. Heat sealer—sufficient for sealing the filter bags closed to ensure complete closure (1915, ANKOM Technology).
6. Desiccator pouch—collapsible sealable pouch with desiccant inside that enables the removal of air from around the filter bags (MoistureStop Weigh Pouch, ANKOM Technology).
7. Marking pen—solvent and acid resistant (F08, ANKOM Technology).

REAGENTS

1. Neutral Detergent Solution—Add 30.0 g sodium lauryl sulfate, USP; 18.61g Ethylenediamine-tetraacetic disodium salt, dihydrate; 6.81 g sodium tetraborate decahydrate; 4.56 g sodium phosphate dibasic, anhydrous; and 10.0 ml triethylene glycol, in 1 L distilled H_2O (premixed chemical solution available from ANKOM Technology). Check pH range to 6.9 to 7.1. Agitate and heat to aid solution. (see Notes, *Caution*).
2. Alpha-amylase—Heat-stable bacterial alpha-amylase; activity = 17,400 Liquefon Units / ml (FAA, ANKOM Technology).
3. Sodium sulfite— Na_2SO_3 , anhydrous (FSS, ANKOM Technology).

PREPARATION OF SAMPLE

Grind samples in a centrifugal mill with a 2 mm screen or cutter type (Wiley) mill with a 1 mm screen. Samples ground finer may have particle loss from the filter bags and result in low values.

PROCEDURE

1. Use a solvent resistant marker to label the filter bags. Weigh filter bag (W_1) and zero balance.
Note—Do not pre-dry filter bags; any moisture will be accounted for by the blank bag correction.
2. Weigh 0.45-0.55 g of prepared sample (W_2) directly in filter bag. Avoid placing the sample on the upper 4 mm of the bag.
3. Using a heat sealer, completely seal the upper edge of the filter bag within 4 mm of the top.
Note—Use sufficient heat to completely seal the filter bag and allow enough cool time (2 sec) before removing the bag from the heat sealer.
4. Weigh one blank bag and include in run to determine blank bag correction (C_1).
5. **Pre-extract only samples containing soybean products or >5% fat:** Extract samples by placing 24 bags with samples into a container with a top. Pour enough acetone into container to cover bags and secure top. Shake the container 10 times and allow bags to soak for 10 minutes. Repeat with fresh acetone. Pour out acetone and place bags on a wire screen to air-dry. **Exception - Roasted soybean:** Due to the processing of roasted soy a modification to the extraction is required. Place roasted soy samples into a container with a top. Pour enough acetone into container to cover bags and secure top. Shake the container 10 times and pour off acetone. Add fresh acetone and allow samples to soak for twelve hours. After soak time, pour out acetone and place bags on a wire screen to air-dry.
6. Place a maximum of 24 bags into the Bag Suspender. All nine trays should be used regardless of the number of bags being processed. Place three bags per tray and then stack trays on center post

with each level rotated 120 degrees. Insert the Bag Suspender with bags into the fiber analyzer vessel and place the Bag Suspender weight on top of the empty 9th tray to keep it submerged.

Note—Prior to inserting the Bag Suspender, if the vessel temperature is warm from a previous run, add cold water and exhaust.

7. Follow the directions on the ANKOM²⁰⁰⁰ display:
 - a. Select NDF
 - b. **Wait** to close Lid
 - c. Confirm hot water is on (>70°C)
 - d. Press START
 - e. After ND solution has been automatically inserted and agitation begins, manually add 20 g of Na₂SO₃ and 4.0 mL of alpha-amylase.
 - f. Close lid
8. Attach amylase dispenser to Port B and fill with 8.0 mL of alpha-amylase diluted to a volume of 350 mL. The ANKOM²⁰⁰⁰ will automatically add this amylase solution to the first and second rinse.
9. When the NDF extraction and rinsing process is complete, open the lid and remove the samples. Gently press out excess water from bags. Place bags in a 250 mL beaker and add enough acetone to cover bags and soak for 3-5 min.
10. Remove bags from acetone and place on a wire screen to air-dry. Completely dry in oven at 102±2°C (most ovens will complete drying within 2-4 hrs).

Note—Do not place bags in the oven until acetone has completely evaporated.

11. Remove bags from oven, place directly into a collapsible desiccant pouch and flatten to remove air. Cool to ambient temperature and weigh bags (W₃).

Note—Do not use conventional desiccator container.

CALCULATIONS

$$\% \text{ NDF (as-received basis)} = \frac{(W_3 - (W_1 \times C_1))}{W_2} \times 100$$

Where: W₁ = Bag tare weight
W₂ = Sample weight
W₃ = Dried weight of bag with fiber after extraction process
C₁ = Blank bag correction (final oven-dried weight divided by the original blank bag weight)

NOTES

Caution

Powdered chemicals will irritate the mucous membranes. A dust mask and gloves should be worn when handling this chemical.

Acetone is extremely flammable. Avoid static electricity and use a fume hood when handling.