APPLICATION NOTE

F&F-F-003-2019/A1

Crude Fiber Determination in Feed

(Weende method)

Reference: **ISO 6865:2000** Animal feeding stuffs - Determination of crude fibre content
AOAC 978.10 Fiber (Crude) in Animal Feed and Pet Food
REG CE 152/2009
Tested with **VELP Scientifica FIWE Advance Fiber AutoExtractor** (Code F30500500)
and **COEX Cold Extractor** (Code F30520204)

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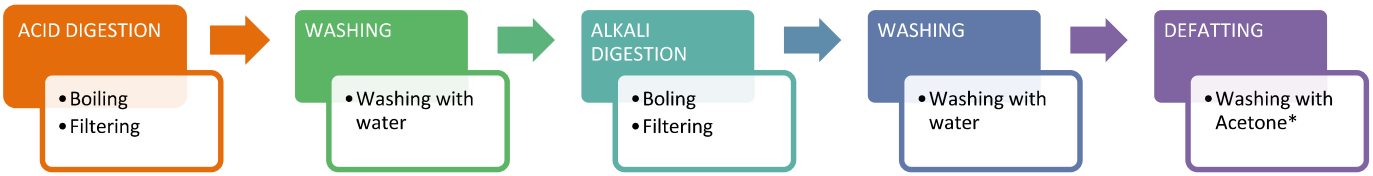
CF DETERMINATION IN FEED

Introduction

Fiber is found in the cell walls of plants, and functions sort of like a skeleton for the plants to help maintain their shape and structure. Plant fiber is mainly consisted of cell wall which is comprised of substances such as cellulose, hemicellulose, ligning and pectine.
Fiber is nutritionally important because it represents the organic portion of feeds and foods that is the most difficult to digest.
Forage quality is a direct reflection of essential nutrient content and availability to the consuming animals and generally there is a close relationship between the crude fiber content and the nutrition value of the feed: the higher the crude fiber is, the lower the nutritional value is. Fiber is thus an important parameter to be determined in feed.
The performance of VELP FIWE Advance Fiber AutoExtractor was evaluated by participating in the proficiency testing program organized by BIPEA. Samples were analyzed using FIWE Advance Fiber analyzer and the obtained results were compared with the BIPEA tolerance range.

Determination of Crude Fiber content in different feed samples

The CF determination can be summed up in 5 steps:



*performed with COEX

During the ACID DIGESTION (BOILING & FILTERING) the feed sample is boiled in sulfuric acid 1,25 % for the extraction of sugar and starch.
During WASHING the residues into the crucibles are washed with water to remove acid residues and neutralize the pH.
The second digestion is the ALKALY DIGESTION with 1.25 % sodium or potassium hydroxide which removes proteins, some hemicellulose and lignin. Then the WASHING step is performed again in order to remove the alkali residues into the crucibles with water and neutralize the pH. The final step is the DEFATTING of the samples where the last washes are performed with acetone.

BIPEA Samples

Common wheat	ID: 12-1113-0188	CF assigned value: 2.6 %	Tolerance range: 1.8 – 3.4 %
Feed for piglet	ID: 12-1513-0207	CF assigned value: 3.2 %	Tolerance range: 2.4 – 4.0 %
Production corn	ID: 15-0513-0073	CF assigned value: 2.0 %	Tolerance range: 1.2 – 2.8 %

Chemicals and Equipment required

- Analytical balance, 4 decimals
- Glass Crucibles P2, 6pcs (A00000140)
- Sulfuric acid (H_2SO_4) 1.25% - 0.255 ± 0.005 N. 12.5 g, 98% concentrated to 1000 ml with distilled water.
- Potassium hydroxide (KOH) 1.25% - 0.223 ± 0.005 N, free from carbonate. 12.5 g to 1000 ml with distilled water.
- n-octanol as antifoaming agent
- Acetone, technical grade

Crucibles Preparation

Connect the optional VELP barcode reader (Barcode scanner with USB socket Code: A00000364 or Wireless barcode scanner Code: A00000365) to the FIWE Advance. Select Analysis/Details, scan the crucible, weigh 1 g of the sample portion into each crucible (M_{sample}) and transfer the M_{sample} value from the balance to FIWE Advance. This operation is repeated sequentially for the remaining positions.

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Digestion and filtration with FIWE Advance

Select “Analysis” and then method “CF - Crude fiber (Weende method)” including the following parameters:

- Crucibles porosity P2
- Preheat: Yes
- Enzyme: No
- H_2SO_4: 150 ml
- N-octanol: Yes
- Digestion time: 30 minutes
- Washing: 3 x 50 ml of distilled water
- KOH: 150 ml
- Digestion time: 30 minutes
- Washing: 3 x 50 ml of distilled water

Lower the lever and position the heating shield.
Press START to begin the process. At the end of analysis remove the crucibles from the unit, place them in COEX unit for defatting (25 ml acetone for 3 times) and dry the crucibles (130 °C ± 2 °C). Leave to cool in the desiccator. In Result menu select the crucibles batch ID analyzed, press calculate, scan the crucibles with barcode reader and weigh to the nearest 0,0001 g (M_{dry}). Ignite the crucible with the residue in a muffle (525 ± 15 °C) for at least 3 h or until carbon-free. Leave to cool in a desiccator. In Result menu select the crucibles batch ID analyzed, press calculate, scan the crucibles with barcode reader and weigh to the nearest 0,0001 g (M_{ash}).

Results on feed samples

$$\% \text{ Crude Fiber} = \frac{M_{dry} - M_{ash}}{M_{sample}} * 100$$

M_{dry} = sample weight after drying

M_{ash} = sample weight after ashing

M_{sample} = sample weight

Sample	M_{sample} (g)	M_{dry} (g)	M_{ash} (g)	CF %
Common wheat	0.9958	31.2625	31.2364	2.6210
	1.0009	31.3139	31.2874	2.6476
	1.0112	31.0186	30.9923	2.6009
			Average ± SD%	**2.62 ± 0.02**
			RSD% *	**0.9**
Feed for piglet	1.1584	31.0613	31.0227	3.3322
	0.9958	31.5771	31.5437	3.3541
	1.0856	31.5345	31.4978	3.3806
			Average ± SD%	**3.36 ± 0.02**
			RSD% *	**0.7**
Production corn	1.0555	30.9845	30.9634	1.9991
	1.0795	31.3327	31.3108	2.0287
	1.0079	30.9953	30.9748	2.0339
			Average ± SD%	**2.02 ± 0.02**
			RSD% *	**0.9**

* RSD% = (Standard Deviation * 100) / Average

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Conclusion

The obtained results are reliable and in accordance with the expected values, with a low relative standard deviation (RSD ≤1%), that means high repeatability of the results.
The use of an extraction apparatus purposely devised for this method as FIWE Advance unit, makes very easy the standardization of analytical conditions. The FIWE Series is suitable for Crude Fiber (CF) determination and fiber fractions.

Benefits of FIWE Advance are:

- 6 positions simultaneously and unsupervised
- Easy to use: 7" touch screen operation with preset method and favorite methods setting
- Automatic heating and dispensing of reagents avoiding any possible contact with chemicals and fumes
- State-of-the-art safety features controlling all the steps of the analysis
- Precision and accuracy: high reproducibility of the results: ± 1% relative or better
- Results in accordance with official procedures
- Connection to VELP Ermes cloud platform to monitor and control the instrument and to access to your database.

In order to avoid losses of fiber, it's important to remember that crucibles life is around 20-30 analysis, because the fritted filter could be damaged from basic and acid solutions. Hence it's suggested to change them after 20-30 analysis.

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