

Crude Fiber Determination in Oatmeal according to Weende

Reference: **AACC, Method 32-10.01** Crude Fiber in Flours, Feeds, and Feedstuffs

Tested with **VELP Scientifica FIWE 6 Fiber Analyzer** (Code F30520200).



Introduction

Oats are a whole-grain cereal, known scientifically as *Avena sativa*. They are mainly grown in North America and Europe.

This whole-grain are a very good source of fiber, and are high in vitamins, minerals and antioxidants.

Oats contain more soluble fiber than other grains, leading to slower digestion, increased satiety and suppression of appetite. Most of the soluble fiber is composed of beta-glucans.

Beta-glucans are known to lower cholesterol levels and increase excretion of bile acids. They are also believed to cause a reduction in blood sugar and insulin levels after a carbohydrate-rich meal.

Daily consumption of beta-glucans has been shown to lower cholesterol, especially LDL (the “bad”) cholesterol, and may therefore decrease the risk of heart disease.

Oats also contain insoluble fibers, including lignin, cellulose and hemicellulose.

Fiber Determination in Oatmeal according to Weende method

The method is based on the solubilization (digestion) of non-cellulosic compounds by sulfuric acid and potassium hydroxide solutions. Crude fiber is the loss on ignition of the dried residue remaining after digestion of the sample and determined by weight difference. This method is applicable to grains, meals, flours, feeds, and fiber-bearing material from which fat can be extracted to leave workable residue.

Reagents

1- Sulfuric acid (H₂SO₄) 1.25% - 0.255 ± 0.005 N. 12.5g, 98% concentrated to 1000 ml with distilled water.

2- Potassium hydroxide (KOH) 1.25% - 0.223 ± 0.005 N, free from carbonate. 12.5 g to 1000 ml with distilled water.

3- n-octanol as antifoam.

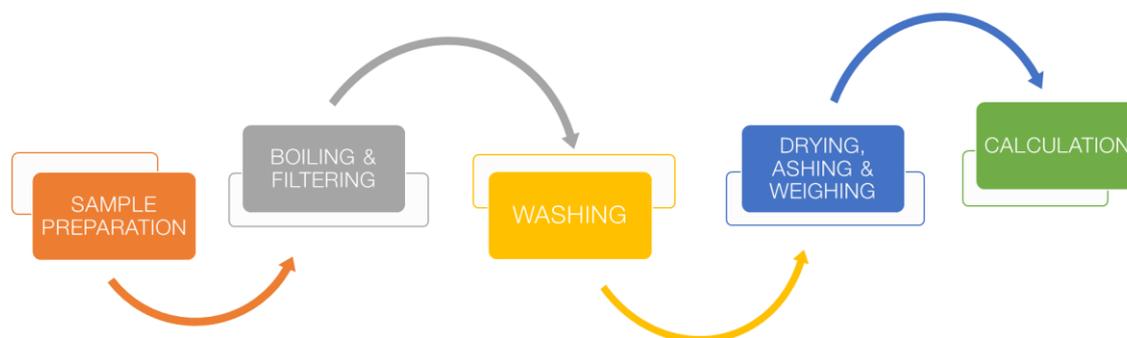
3- Anhydrous acetone

Sample

Oatmeal Crude Fiber labeled value: 7.0 ± 0.6

Analysis Procedure

The diagram below shows the steps involved in the procedure:



1. Dried the sample by heating in an oven at 105 °C to constant weight. Cool in a desiccator.
2. Weight accurately 1 g about of dried and homogeneous sample (1 mm about) approximately with 1 mg (M_{sample}).
3. Add 1.25% sulfuric acid up to the 150 ml notch, after preheating by RC2 hot plate (cod. F20700430) in order to reduce the time required for boiling.
4. Add 3-5 drops of n-octanol as antifoam agent.
5. Boil 30 minutes exactly from the onset of boiling.
6. Connect to vacuum for draining sulfuric acid.
7. Wash three times with 30 ml of hot deionized water (crucible filled up to the top), connecting each time to compressed air for stirring the content of crucible.
8. After draining the last wash, add 150 ml of preheated potassium hydroxide (KOH) 1.25% and 3-5 drops of antifoam.
9. Boil 30 minutes.

10. Filter and wash as point 7.
11. Perform a last washing with cold deionized water aimed to cool the crucibles and then wash three times the crucible content with 25 ml of acetone, stirring each time by compressed air.
12. Remove the crucibles and determine the dry weight after drying in an oven at 130 °C for 2 hours or at 105 °C for at least 8 hours. Let cool in a desiccator. This weight represents the crude fiber plus ash content (M_{dry}).
13. The crucibles are then placed in a muffle and heat up to 525 °C for three hours and reweighed after cooling in a desiccators (M_{ash}).
14. Remove ash and if necessary clean the crucibles by an oxidizing procedure.

Calculation

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

M_{sample} = sample weight

M_{dry} = crucible weight with fiber and ashes, after drying in an oven at 130 °C for 2 hours

M_{ash} = crucible weight with ashes, after muffle at 525 °C for three hours

Typical Results on Oatmeal

M_{sample} (g)	M_{dry} (g)	M_{ash} (g)	Fiber %
0.985	30.5253	30.4533	7.31
1.010	30.4192	30.3444	7.41
0.968	30.3726	30.3001	7.49
0.970	30.3752	30.3043	7.31
1.024	29.9166	29.8414	7.35
0.970	30.4862	30.4146	7.38
		Average ± SD%	7.37 ± 0.07
		RSD% *	0.9

Fiber Labeled Value: 7.0 ± 0.6%

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

Conclusion

The obtained results are reliable and in accordance with the labeled value. The use of an extraction apparatus purposely devised for this method as FIWE unit, makes very easy the standardization of analytical conditions. The FIWE Series is suitable for Crude Fiber (CF), Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF) and Acid Detergent Lignin (ADL).

Benefits of FIWE are:

- 3 or 6 positions simultaneously: FIWE units can support up to 3 (FIWE 3) or 6 (FIWE 6) crucibles. Samples can also be processed individually
- Time saving: fast analysis (2 hours with FIWE vs. 6 hours manually)
- Easy to use: convenient filtration, with pump and air pressure
- Precision and accuracy: high reproducibility of the results: ± 1% relative or better

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.