Nutrition/ Practical / second stage

Determination of crude fiber – Muslin cloth method

What is Fiber?

Fiber is the predominant fraction of the plant cell wall and primarily comprised of carbohydrates. The primary components of fiber are cellulose, hemicellulose, and lignin. On a chemical basis, cellulose is comprised of linear chains of the sugar. Starch, the carbohydrate source in grains, is also comprised of glucose molecules. In cellulose, glucose molecules are linked together in a b1,4 link whereas in starch, it is an a1,4 link. Only microbial enzymes can digest the b1,4 linked glucose in cellulose.

Hemicellulose is also dependent on microbial enzymes for digestion because it has a complex structure made primarily of the sugar xylose that is also in b1,4 links. Hemicellulose is closely associated with lignin that has a strong negative influence on fiber digestion.

Principle

The feed sample is subjected to acid digestion followed by base digestion and the remaining residue is weighed and ashed. The loss of weight after ashing is the crude fibre content of the feed.

Apparatus and Equipment

1. Analytical balance.
2. Muffle furnace
3. Electric heater/hot plate
4. Oven
5. Beaker 500 ml
6. Conical flask
7. Crucible
8. Cotton cloth
9. Funnel

10. Spoon
11. Desiccator.
12. Marker pen

Reagents

1. 0.128M H_2SO_4: Dilute 3.49ml H_2SO_4 (98%) in 500ml distilled water.
2. 0.313M NaOH: Dissolve 6.25g NaOH palette in 500ml distilled water.

Procedure

a) Digestion in acid

Measure 200ml of (0.128M H2SO4). Pour the acid solution into Conical flask (500ml). Weigh 2g (W1) of the sample. Transfer the sample the conical flask to mix with acid solution. Place the flask on a hot plate and boil the sample for 30 minutes. Shake the flask periodically to ensure the proper boiling of sample.

Filtration

Set up a funnel in a large conical flask. Fix a linen cloth over the funnel. Transfer the contents from the beaker to the filtering funnel. After all the acid and acid digested residues are transferred to the linen cloth, wash the beaker with distilled water and transfer the contents to the filtering funnel. Continue the washing till the residue is made acid-free.

b) Digestion in Base

Measure 200ml of (0.313M NaOH) solution. Pour the NaOH solution into Conical flask (500ml) washing the filtrate. Rotate the flask to mix and place on hot plate. Boil sample with periodic agitation. Place the flask on a hot plate and boil the sample for 30 minutes. Shake the flask periodically to ensure the proper boiling of sample. Again, filter the sample to drain NaOH solution.

c) Drying and incineration

1. Weigh the crucible Empty.
2. Collect the filtrate in a clean and dried crucible till on filtrate is left.
3. Put the crucibles in an oven adjusted to 103 ± 2 °C and dry for 4 hours. The drying time starts when the oven has reached 103 °C.
4. Place the crucibles in a desiccator and allow to cool.
5. Weigh the crucible directly after removing from the desiccator (W2).
6. Place the crucibles in a muffle furnace, and incinerate the samples for 2 hours at 550 ± 20 °C. The incineration time starts when the furnace has reached 550 °C.
7. Place the crucibles in a desiccator and allow to cool.
8. Weigh the crucible directly after removing from the desiccator (W3).

Calculation

Percent Crude fibre (% CF):

% CF = (W2 – W3) / W1 x 100

Where:

W1 = weight of the sample (g).

W2 = residue after drying (g).

W3 = residue after incineration (g).