

## **Determination of Crude Fiber**

### **What is Crude Fiber?**

Crude fiber is the residue of plant materials remaining after solvent extraction followed by digestion with dilute acid and alkali. The amount of indigestible **cellulose, hemicellulose, and lignin** in plant-based foods is measured in the diet as “crude fiber.” It is a component of the proximate analysis of food, a technique for determination of crude fiber to analyze the nutritional value of food.

The crude fiber content of a food sample is determined by subjecting the sample to a series of chemical treatments to remove all soluble and easily digestible components, such as **sugars, starches, and proteins**. Crude fiber is considered as the residual byproduct.

### **Application of determination of crude fiber**

The application of crude fiber analysis is primarily in the evaluation of the nutritional quality of animal feed and some plant-based foods.

- **Animals Feed:** Crude fiber analysis is used to determine the quantity of indigestible structural carbohydrates in animal feed.
- **Food Industry:** In the food industry, crude fiber analysis is also used to assess the fiber content of certain plant-based foods such whole grains, vegetables, and fruits.
- **Research:** The effects of dietary fiber on health outcomes, such as improving digestion, reducing cholesterol levels, and preventing chronic illnesses like heart disease and diabetes.

### **Health Benefits of Crude Fiber**

Crude fiber, which is primarily composed of cellulose, hemicellulose, and lignin, provides numerous health benefits when included in a well-balanced diet. Here are some of the key health benefits of crude fiber:

- **Improved Digestion:** Crude fiber acts as a natural laxative, promoting regular bowel movements and preventing constipation. Additionally, it helps to balance out the good bacteria in the stomach.
- **Reduced Cholesterol level:** A high-fiber diet has been showed to reduce cholesterol levels.
- **Weight Managements:** Crude fiber-rich foods have a tendency to have few calories and may help in promoting satiety and fullness sensations.
- **Blood Sugar Regulation:** Crude fiber can help to regulate blood sugar levels by slowing down the absorption of glucose in the bloodstream.
- **Reduced Risk of Chronic Diseases:** Consuming sufficient amounts of fiber from food has been associated with a lower risk of chronic conditions like heart disease.

## **Crude Fiber – Filtration Method**

### **1. Principle**

The sample after defatting is sequentially treated with boiling dilute sulphuric acid, and boiling potassium hydroxide solution. The loss in mass resulting from incineration corresponds to the mass of crude fiber.

### **3 Equipment**

1. Analytical balance.
2. Glass filter crucibles.
3. Heating apparatus.
4. Filtration equipment, connected to a vacuum system, for example a Fibertec system.
5. Desiccator.
6. Drying oven ventilated, capable of being maintained at a temperature of  $103 \pm 2$  °C.

7. Muffle furnace, capable of being maintained at a temperature of  $550 \pm 20$  °C.

#### **4. Reagents**

1. Petroleum ether (boiling point 40 to 60 °C).
2. Sulphuric acid, 0.15 M.
3. Acetone technical quality.
4. Potassium hydroxide, 0.23 M.

#### **5. Procedure:**

##### **A-Pretreatment**

1. To each crucible weight 2 g of the sample (W1).
2. Place the crucibles in the filtration equipment and add approximately 30ml of petroleum ether to each crucible and filter using vacuum.
3. Repeat the washing two times.
4. Dry the residue in air and transfer quantitatively to a beaker.

##### **B- Digestion**

1. Add to each beaker 150 ml sulphuric acid and boil for  $30 \pm 1$  minutes. If foaming occurs, add a few drops of anti-foaming agent.
2. Filter the mixture through a crucible using vacuum.
3. Wash the residue 5 times, each time with 10 ml of hot distilled water.
4. Add a volume of acetone to just cover the residue. Remove the acetone after a few minutes by applying slight suction.
5. Transfer the residue quantitatively to a beaker.
6. Add to each beaker 150 ml potassium hydroxide and boil for  $30 \pm 1$  Minute.
7. Wash the residue 3 times under vacuum, each time with 30 ml of acetone. Dry the residue after each washing.

**C- Drying and incineration**

1. Put the crucibles in an oven adjusted to  $103 \pm 2$  °C and dry for 4.0 hours. The drying time starts when the oven has reached 103 °C.
2. Place the crucibles in a desiccator and allow to cool.
3. Weigh the crucible directly after removing from the desiccator (W2).
4. Place the crucibles in a muffle furnace, and incinerate the samples for 2 hours at  $550 \pm 20$  °C. The incineration time starts when the furnace has reached 550 °C.
5. Place the crucibles in a desiccator and allow to cool.
6. Weigh the crucible directly after removing from the desiccator (W3).

**7. Calculation**

Percent Crude fiber (% CF):

$$\% \text{ CF} = (W2 - W3) / W1 \times 100$$

Where:

W1 = weight of the sample (g).

W2 = weight crucible and residue after drying (g).

W3 = weight crucible and residue after incineration (g).