

# Determination of crude fiber



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Dietary fiber can be defined as sum of polysaccharides and lignin that are not digested by human digestive enzymes. The major components of dietary fiber are cellulose, noncellulose such as hemicelluloses and pectin, lignin, and hydrocolloids (gums, mucilages, and algal polysaccharides). Human foodstuffs contain mainly noncellulose polysaccharides, some cellulose and little lignin. The average proportions of noncellulose polysaccharides.

Cellulose and lignin for common foodstuff are about 70%, 20% and 10% respectively (Laura and other 2003).

The crude fiber method was developed in the 1850s to estimate indigestible carbohydrate in animal feeds. Since an easy alternative was not available, fiber in human foods was measured as crude fiber until the early 1970s (except for Southgate in England). Crude fiber method is one of the gravimetric method that measures the organic food residue remaining after sequential digestion with 0.255N sulphuric acid and 0.313N sodium hydroxide solutions, followed by oven-drying at 104°C overnight and ignition in muffle furnace at 600°C for 3 hours. The compounds removed are predominantly protein, sugar, starch, lipids and portions of both the structural carbohydrates and lignin. Crude fiber method measures variable amounts of the cellulose and lignin in the sample, but hemicelluloses, pectins, and added gums or hydrocolloids are solubilised and removed. Therefore, crude fibre measurement drastically underestimates dietary fibre in foods since it measures only cellulose and lignin. As a result, crude fiber method is only adequate for determination of fiber in animal feed product, but not suitable for human food analysis as lignin is significant to human health (James N. BeMiller 2003)

**Determination of carbohydrate**

Carbohydrates are important in food because carbohydrates provide energy, enhance immune function and support cellular communications.

Carbohydrates are converted into energy to allow our cells to function. There are two major types of carbohydrates such as complex carbohydrates and simple carbohydrates. Complex carbohydrates are glycogen in human tissue and cellulose in plant tissues. Simple carbohydrates are monosaccharide such as glucose, fructose, galactose and disaccharides like maltose, lactose and sucrose (DeWayne McCulley 2005).

The most important sources of carbohydrates are plant food such as fruits, vegetables and grains. Milk and milk products contain the carbohydrates lactose (milk sugar) but meat, fish and poultry have no carbohydrate at all. One gram of carbohydrates has four calories. To find the number of calories from the carbohydrates in a serving, multiply the number of grams of carbohydrates by four. For example, one whole bagel has about 38 grams of carbohydrates, equal to about 152 calories (Carol Ann Rinzler 2006).

The determination of carbohydrates is one of the most frequently required analyses in the food analysis laboratory and has considerable application in nutritional and biochemical studies. The variety of food and beverage products from food manufacturers continues to expand. This variety, combines with raised expectations of quality and consistency from the consumer, has created a need for analytical methods that provide specific data on the composition of both raw materials and final products. Analyses for carbohydrates must be applicable to simple ingredients, complex

processed foods, and fractions or components isolated in nutritional studies. (Eliasson, 2006)

There are several methods of carbohydrate analysis and can be divided into physical methods and chemical method. Physical methods generally determined some overall features of the sugars in food such as total carbohydrates. The physical methods include refractometry, polarimetry and hydrometry. Unlike physical methods, chemical methods are able to determined more specific features, for example, reducing sugar. In this experiment, carbohydrates in foods were determined by difference after knowing the content of other food components. The accuracy of the “ by difference” method depends on the determination of other food components and does not make any distinction between the available and nonavailable carbohydrates. The advantage of this method is carbohydrates content can be calculated without carry out an experiment (Nollet 2004).

### **Determination of Vitamin C**

Ascorbic acid (vitamin C) which forms cementing substance such as collagen in the body is important in wound healing and increasing resistance to infections. This vitamin also enhances the absorption of non-heme iron and may protect against some cancers and cardiovascular disease. Milk contains only a small amount of ascorbic acid (0.94 mg per 100g milk). Processing or exposure to heat such as pasteurization reduces the vitamin C content of milk. The current RDA for vitamin C for most adults is 60mg per day (Gregory and others 1999). Besides, pregnant women need a moderate increased for vitamin C during last trimester to meet the needs of the growing fetus. The vitamin C content in food is strongly influenced by length of time on the shelf

and in the storage and cooking practice likes the heating and exposure to copper or iron or to mildly alkaline conditions destroys the vitamin (World Health Organization 1998).

The AOAC method for determining vitamin C in food is based upon the reduction of the dye 2, 6-dichlorophenolindophenol (DCPIP) with ascorbic acid in an acid solution. DCPIP is used as the titrant because it only oxidizes ascorbic acid and not other substances that might be present. Besides, it acts as a self-indicator in the titration because it changes to another color when in excess analyte (ascorbic acid). In the oxidized form, DCPIP is purplish-blue in neutral or alkaline solution, and pink in acid solution; the reduced form of dye is colorless. The solution will remain colorless as more DCPIP is added until all of the ascorbic acid has reacted. As soon as the next drop of DCPIP solution is added at the solution and the solution is turn to light red or pink due to the excess DCPIP, the end point of the titration is reached. Hence, the ascorbic acid is oxidized to dehydroascorbic acid by DCPIP solution. However, this method is not capable of determining dehydroascorbic acid content that presents more or less 80% of vitamin C activity shown by ascorbic acid. The diagram below show the reaction between ascorbic acid and 2, 6-dichloroindophenol (DCPIP). (Ball 1997)

### **Redox reaction between ascorbic acid (vitamin C) and 2, 6-dichlorophenolindophenol (DCPIP).**

Before using DCPIP to quantitatively measure vitamin C, the concentration of the DCPIP solution must be known. The concentration of DCPIP solution can be determined by react the DCPIP solution with a solution of ascorbic acid with a known concentration. This is known as “ standardizing” the solution

and it must be done before determine the concentration of vitamin C of sample.

The vitamin is very susceptible to oxidative deterioration, which is enhanced by high pH and by the presence of ferric and cupric ions. For this reason, the entire analytical procedure needs to be performed at low pH and in the presence of a chelating agent if necessary. (Ronald and Landen 2003) For example, ascorbic acid is extracted from food and titrated with the indicator in the presence of acid like oxalic acid. These acids are used to preserve the correct acidity for reaction and to avoid auto oxidation of ascorbic acid.

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