

Food chemistry

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Fats and other lipids

- Lipids are one of large groups of organic compounds which are of great importance in the food .

Occurrence in foods

- The American diet unusually rich in fats and other lipids

Edible fats and oils

- Prepared edible fats and oils which are sold in pure state

Fatty acids

- Natural fats are mixed glycosides in which the three fatty acids

Identification of natural fats and oils

- 1- physical properties
- 2- chemical properties

1- physical properties

- A- melting point of fat

B- Softening point of fat

- Capillary tubes are filled with oil and packed in ice over night so that the oil can be solidify and come to equilibrium .
- The capillary tubes are clamped to a thermometer and submerged in a beaker of water .
- The temperature is slowly raised and the temperature at which the column of fat rises in the capillary tube is called the softening point

C – Slipping point

- Small brass cylinders filled with the solid fat are suspended in a bath close to the thermometer . As the bath is stirred the temperature is slowly raised . The point at which the fat rises in the cylinder or slips is recorded as slip point.

D – Shot melting point

- Is the temperature at which a small lead shot will fall through a sample

E – Specific gravity

- The specific gravity of fat or oils usually measured at 25 C. But it may be necessary to use temperature of 40 C or even 60 C for high melting fats .

F – Refractive index

- Is the degree of deflection of a beam of light that occurs when it passes from one transparent medium to another.
- Abbe Refractometer at 25 C. with high melting point fats 40 C or even 60 C.

G – Smoke , Flash and Fire points

- Smoke point: is the temperature at which a fat or oil gives off a thin bluish smoke .
- Flash point : is the temperature the mixtures of the mixtures of vapors with air will ignite .
- Fire point: is the temperature at which the substance will sustain continued combustion

H – Turbidity point

- The turbidity point of an oil determined by a mixture of it and a solvent in which it a limited solubility . The mixture is warmed until complete solution occurs. And then slowly cooled until the oil begins to separate and turbidity occurs. The temperature at which turbidity first detectable is known as turbidity point.

Chemical Properties

A number of chemical tests have been evolved during the years of study of oils and fats which are based on the partial determination of the chemical composition of the oil or fat . These tests serve both to identify the fat and to detect the presence of adulteration .

Reichert Meissl Number

Is the number of milliliters of 0.1 N alkali (such as potassium hydroxide) required to neutralize the volatile water-soluble fatty acids in 5 g. sample of fat. The Reichert Meissl test determines the amount of butyric and caproic acids which are readily soluble in water and the caprylic and capric acids which are slightly soluble.

Polenske number

Is the number of milliliters of 0.1 N alkali necessary to neutralize the volatile, water – insoluble fatty acids which are present in 5 g. sample .

The Saponification number

is defined as the number of milligrams of potassium hydroxide required to saponify 1 g. of fat or oil.

iodine number

is the number of grams of iodine or iodine compounds absorbed by 100 g. of fat.

The Acetyl Value

is a measure of the amount of hydroxyl fatty acids present in a fat .

PHYSICAL AND CHEMICAL PROPERTIES

By the use of the physical constants and the chemical methods it is possible to differentiate and identify natural oils and fats .

Flavor changes in fats and oils

When fats and oils are stored they undergo flavor changes which markedly influence their market value.

Rancidity

Fats and oils slowly take up oxygen for a period of time before it is possible to detect the flavor of the products of rancidity . This period is called the induction period , and it is followed by a second period in which the uptake is much more rapid .

Temperature ,moisture ,the amount of air in contact with the fat ,light ,and presence or absence of antioxidants influence the reaction .

Long ago farm women learned to store fat in crocks with as small a surface exposed to the air as possible .

Vegetable fats especially those from seeds show a marked resistance to the onset of rancidity .

The uptake of oxygen and the onset of rancidity seems to be related to the unsaturation of the fat .

Tocopherols and Vitamin E act as antioxidants.

Sugar in cookies and biscuits appears to have a marked inhibiting effect on the onset of rancidity .

Tests for rancidity

- 1-Peroxide value
- 2-Determination of carbonyl
- 3-Active oxygen determination
- 4-Thio-barbituric acid test
- 5-Schaal oven test

Peroxide value

measures the amount of iodine released when potassium iodide reacts with rancid fat .The Lea method uses 1 g. of fat and 1 g. of potassium iodide with an acetic acid :chloroform (2:1)solvent .After heating , the iodine formed is determined by titration with standard thiosulfate. Other methods modify quantities of solvent , but the principle remains the same

The measurement of carbonyl compounds

has followed traditional methods for this group .2,4 dinitro phenyl hydrazine is commonly used in the Lappin-Clark . method

Active oxygen

is a method which measures the length of time required to produce 20 mg peroxide per 1000g. fat when air is bubbled through fats under standard conditions . A bubble train is set up so that clean .

Dry air bubbles through the oil at constant rate such as 2.33 ml per sec.

The oil is heated in a constant –temperature bath. Other samples are added at definite time intervals so that the time required for 20 mg can be calculated .

Thio-barbituric acid test (TBA) method

for determining rancidity : an oxidized or rancid fat will react with 2-thiobarbituric acid (TBA) to form a red color the intensity of which is proportional to the amount of rancidity . In recent years this has been developed into a method for measuring the extent of rancidity in a sample of fat . In the rancid fat the compound formed which reacts with the 2-thiobarbituric acid is malonaldehyde, $\text{CH}_2(\text{CHO})_2$.

Schaal oven test

is widely used in the baking industry .

It takes little equipment and is very easy to set up .

Biscuits or cookies are stored in beakers or jars with loose fitting tops at 63 C or 145 F. The number of days required to develop rancidity is measured by odor and taste .The temperature is slightly above what might be encountered during distribution of the food through regular commercial channels. Its greatest use is in comparing fats .It is difficult to equate shelf life of a product with the Oven Test where conditions are variable .

Thank you

