**ANIMAL NUTRATION\ PARACTICAL\ MAETER**

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**Fat Definition**

Fat is a term used to describe a class of macro nutrients used in metabolism called triglycerides.

**Advantages of fat**

* These make up one of three classes of macronutrients including proteins and carbohydrates.
* Fats provide a means of storing energy for most eukaryotes,
* as well as act as a food source.
* Fats have the highest energy storage potential of the macronutrients, and are very chemically stable, making them ideal for storing energy for later use. Macronutrients does not refer to the size of the molecule, but to the amount needed to sustain life.

**FUNCTION OF THE FAT**

* The importance of fats is an essential source of energy in the body of living things.
* Important for making a lot of hormones, such as: testosterone.
* Important for the absorption of fat-soluble vitamins, such as: vitamins A, D, E and K.
* Regulating the metabolism process,
* regulating body temperature.
* Reducing joints.
* Protection of the internal organs of the body.
* Promote healthy skin and hair.
* Reducing feelings of depression. Regulating blood sugar levels.

**Types of Fat**

Fat is organized into two subgroups: saturated fat, and unsaturated fat. Unsaturated fat is further classified as monounsaturated fat, polyunsaturated fat, and trans-fat. These different classifications determine the effects of these fats on an organism, and the roles that they have in metabolism.

* Saturated Fat

Saturated fat, or animal fat, is composed of a glycerol backbone with three fully saturated fatty acids attached. Saturated refers to all the carbons in the backbone being sp3 hybridized, with two hydrogen atoms covalently bonded per carbon. This class of fats have higher viscosity and energy content than their unsaturated cousins. Due to poor solubility issues, this is the type of fat that is most commonly associated with heart disease.

* Unsaturated Fat

Unsaturated fat, or vegetable fat, is composed of a glycerol backbone with three fatty acid chains where there is at least one sp2 hybridized carbon. This forms a double bond somewhere in the chain. Monounsaturated fats have one double bond in the chain, while polyunsaturated fats have two or more

Naturally occurring unsaturated fats, since they are produced by enzymes, have specific stereochemistry. Natural fats always show the cis conformation, which has a higher solubility in water, and is easily broken down by the metabolic machinery. Artificially produced fats, since they are produced using organic synthesis techniques, contain a racemic mixture of trans and cis bonds. Trans fats are less soluble – like saturated fats. However, they are not readily metabolized by cellular machinery.

**Determination Fat Crude or Ether Extract**

The method of estimating the amount of fat in feed materials depends on the property of fat solubility in organic solvents such as (ether, benzene, carbon tetrachloride, hexane, trichlorethylene, benzol, chloroform, alcohol...etc). There are other materials besides the real fat for them. Especially solubility in organic solvents such as waxes, compound lipids (phospholipids), free fatty acids, organic acids (such as lactic acid and acetic acid), sterols, tar, dyes, some vitamins, aldehydes, ketones, and others. Therefore, this extract is called crude fat or etheric extract because ether is the most widely used solvent. There are several Methods for estimating the amount of fat in feed materials, and we will explain the most common method for estimating fat in feed materials, which is the (Soxhle) method.

**Required reagents and equipment:**

1. Solvents Organic: It uses pure ether free of moisture and alcohol.

It has a low boiling point (530C .).

2. Apparatus Soxhlet, which consists of the following parts:

A- Flask Receiving: It is a heat-resistant flask in which the organic solvent is placed.

B.-Cylinder Extraction: It consists of the body in which it is placedThe Soxhlet thimble, in which the sample is placed, and there are two wide tubes on both ends of the cylinder body, from which the solvent vapor exits from the receiving flask to the extraction tube and then to the condenser where it is condensed, thus turning into a liquid that goes back to the extraction tube, and dissolves the fat in the sample. And a thin curved tube that works to empty the solvent into the receiving flask when it reaches a certain height, carrying with it the extracted fat. This tube works on the principle of cross-bowls.

 C- Condenser: the condenser whose lower end forms a tight seal for the extraction cylinder through which the steam passes. It condenses in the form of a liquid that returns to the extraction tube and inside it is a spiral tube through which cold water passes from the lower nozzle, and exits from the upper nozzle, and the condenser ends with a nozzle from the top to allow the exit of steam that The condensate did not condense. from being compressed inside

D.-Thimble Soxhlet: It is a cylindrical, porous, permeable vessel. The sample is placed with it, and it is placed inside the extraction tube, and if it is not available, a fat-free filter paper can be used to make a thimble, and the sample is placed in it.

3-Sensitive Balance.

4. Desiccator.

. 5 . Oven drying (1050C)

**When estimating the fat, the following conditions must be adhered to:**

 1. The feed sample: it must be well ground because the fine parts of the feed are affected by the solvent effectively.

The presence of water in the feed sample helps to dissolve a lot of sugars and other substances, and thus

This affects the result of the analysis.

2. When the feed sample is dried, oxidation of unsaturated fatty acids should not be allowed.

The faster the drying of the feed sample, the lower the degree of fat oxidation, because when fats are oxidized, substances are formed that do not decompose in ether and therefore the result will be less.

3- The ether used to extract the fat must be free from water and from traces of peroxides, alcohol and acetone.

4 .- For the ease of ignition of ether and its vapor and for the fear of a fire, it is necessary to work in a cabinet that contains an air drawer, and another heating device should not be allowed to work in the same room.

5 .-When the Soxhlet fat extraction device works, cold water must be constantly passed through the condenser.

**The method of work:**

1 -. Approximately 2 g is taken from the well-ground and air-dry forage sample, the exact weight is recorded, and placed in a fat-free Soxhlet thimble, and the sample is covered with a layer of glass wool.

Fiberglass), and the sample is covered with a fat-free filter paper after being treated with ether.

2. The receiving flask is weighed, and the weight is recorded exactly to 0.1 mg.

3- Wash the receiving flask, and dry it in a drying oven at a temperature of 105°C until the weight is stable.

4- Place the thimble in place in the extraction tube so that the upper edge of the thimble is lower

At least 5 mm from the top of the bent tube so that all the contents of the thimble can be immersed in ether.

5- The receiving flask with known weight is installed at the bottom of the extraction tube and fixed well with a holder

6- Pure ether is poured from the upper opening of the extraction tube and we continue to pour so that the ether is submerged

Feed sample in the thimble until it flows into the receiving beaker so that the amount of solvent does not exceed two thirds of the volume of the beaker

7- The condenser is installed above the extraction tube, and the water circuit connected to the condenser is opened.

8. Heating the beaker starts either directly with an electric heater or a water bath, but it is not allowed to use any flame at all because the atmosphere is on ether vapors. The intensity of heating must be regulated so that the droplets of the solvent fall rapidly in such a way that it is difficult to count it and do not fall out continuously (the extraction tube is emptied 10-12 times per hour).

9.- The extraction process begins. When the ether is heated in the receiving flask, it evaporates and the vapors rise in the

The wide tube (evaporation tube) then reaches the condenser, then it enters it, and it falls in the form of drops that fall into the extraction tube above the sample, and the solvent touches the sample to be extracted, and a quantity of fat is dissolved. The upper level of the thin curved tube, the solvent flows, carrying the fat, and empties into the receiving flask. As long as the heating continues, the process is repeated several times.

10. The extraction process takes 5-6 hours for samples that have a low percentage of fat, and 10-18 hours for feed rich in fat (lacquers, seeds and oil).

11.-The extraction process can be confirmed by taking two drops of the solvent in the extraction tube by a glass rod and placing it on a filter paper. The extraction process ends when the solvent does not give an oily spot on the filter paper. When the extraction process is completed, the heaters are removed from the receiving flask and the condenser is separated from The device, the thimble is taken out with the sample, then the condenser is reinstalled and the device is turned on again, the solvent is dripping, and the extraction tube is emptied of the solvent

When its quantity reaches the largest possible in the extraction tube (before it reaches the vacuum level), the solvent is emptied and this process is repeated until almost all the solvent inside the receiving flask in the extraction flask is finished in the container designated for it, and the receiving flask is placed with what contains the fat and ether residues. The remainder is placed on a water bath, or left in the room atmosphere until the ether residue volatilizes, then the beaker is dried with fat for two hours at a temperature of 105 °C, then cooled in the glass dryer and weighed and then returned to the oven for one hour, then cooled and then weighed, the drying and weighing process is repeated until a weight is obtained Fixed the beaker, and this is usually enough to re-weigh twice.