**Animal nutration practical master(( 2024-2025)**

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**DETERMINATION OF MOISTURE**

Moisture content is one of the most commonly measured properties of

food materials. It is important to food scientists for a number of different reasons:

* Legal and Labeling Requirements. There are legal limits to the maximum or minimum amount of water that must be present in certain types of food.
* Economic. The cost of many foods depends on the amount of water they contain - water is an inexpensive ingredient, and manufacturers often try to incorporate as much as possible in a food, without exceeding some maximum legal requirement.
* Microbial Stability. The propensity of microorganisms to grow in foods depends on their water content. For this reason many foods are dried below some critical moisture content.
* Food Quality. The texture, taste, appearance and stability of foods depends on the amount of water they contain.
* Food Processing Operations. A knowledge of the moisture content is often necessary to predict the behavior of foods during processing, e.g. mixing, drying, flow through a pipe or packaging.

**It is therefore important for food scientists to be able to reliably measure moisture contents. A number of analytical techniques have been developed for this purpose, which vary in their accuracy, cost, speed, sensitivity, specificity, ease of operation, etc. The choice of an analytical procedure for a particular application depends on the nature of the food being analyzed and the reason the information is needed.**

**Properties of Water in Foods**

 The moisture content of a food material is defined through the following equation:

%Moisture = (mw/m sample) 100

Where mw is the mass of the water and msample is the mass of the sample.

**In principle**:-

the moisture content of a food can therefore be determined accurately by measuring the number or mass of water molecules present in a known mass of sample. It is not possible to directly measure the number of water molecules present in a sample because of the huge number of molecules involved. A number of analytical techniques commonly used to determine the moisture content of foods are based on determinations of the mass of water present in a known mass of sample. Nevertheless, as we will see later, there are a number of practical problems associated with these techniques that make highly accurate determinations of moisture content difficult or that limit their use for certain applications. For these reasons, a number of other analytical methods have been developed to measure the moisture content of foods that do not rely on direct measurement of the mass of water in a food. Instead, these techniques are based on the fact that the water in a food can be distinguished from the other components in some measurable way.

the water molecules in a food may be present in a variety of different molecular environments depending on their interaction with the surrounding molecules.�

 **The water molecules in these different environments normally have different physiochemical properties:**

* **Bulk water**. Bulk water is free from any other constituents, so that each water molecule is surrounded only by other water molecules. It therefore has physicochemical properties that are the same as those of pure water, e.g., melting point, boiling point, density, compressibility, heat of vaporization, electromagnetic absorption spectra.
* **Capillary or trapped water**. Capillary water is held in narrow channels between certain food components because of capillary forces. Trapped water is held within spaces within a food that are surrounded by a physical barrier that prevents the water molecules from easily escaping, e.g., an emulsion droplet or a biological cell. The majority of this type of water is involved in normal water-water bonding and so it has physicochemical properties similar to that of bulk water.
* **Physically bound water**. A significant fraction of the water molecules in many foods are not completely surrounded by other water molecules, but are in molecular contact with other food constituents, e.g. proteins, carbohydrates or minerals. The bonds between water molecules and these constituents are often significantly different from normal water-water bonds and so this type of water has different physicochemical properties than bulk water e.g., melting point, boiling point, density, compressibility, heat of vaporization, electromagnetic absorption spectra.
* **Chemically bound water**. Some of the water molecules present in a food may be chemically bonded to other molecules as water of crystallization or as hydrates, e.g. NaSO4.10H20. These bonds are much stronger than the normal water-water bond and therefore chemically bound water has very different physicochemical properties to bulk water, e.g., lower melting point, higher boiling point, higher density, lower compressibility, higher heat of vaporization, different electromagnetic absorption spectra.

**Determination of moisture in feed sample:**

- **The aim of this experiment:**

* Prepare the samples for chemical analysis and report the chemical analysis on a dry basis.
* Determination of moisture occur to know the spoilage of feed.
* Determination price of forage depend on percentage of moisture

**Scientific principles of experiment:**

The speed of water evaporation from feed surface depend on the vapor pressure of water and temperature.

The partial vapor pressure of water outside feed should be less than the partial vapor pressure of water in feed to facility remove moisture from feed to outer environment.

Note: the normal value of moisture in concentrate about (3%-20%) while the normal value of moisture in green roughage about (75%-80%).

**Equipment and machines used:**

1. Small basin used for concentrate.
2. Large basin used for green roughage.
3. 3-Oven.
4. Desiccators(contain CaCl2)
5. Electrical balance

**Method**

**A-Determination of moisture in concentrates.**

1. Put the clean small basin in oven with 105 ºC for 1hr.
2. Remove the small basin from oven to the desiccators until cool then weight & record it weight when it empty.
3. Weight about (1-2) gram in to a weight basin.
4. Put the basin contain the sample in oven with **105 ºCover night** or in **135 ºC for 3 hrs**.
5. After the end of drying period we removed the basin from oven to desiccators until cool .remove from desiccators and weight as quickly as possible.
6. Calculation of percentage of moisture in sample by



Wt. of moisture = wt.of basin with sample before drying –wt. of basin with sample after drying.

**B- Determination of moisture in green roughage :**

1. Put clean large basin in oven with 105c for 1hr.
2. Remove the basin from oven into desiccators until cool then records its weight by using electrical balance.
3. Weight 10 gram from green roughage (hay, arge basin.
4. Put the sample in oven **with 60º C for 24 hrs.**
5. Remove the basin from oven and put it in desiccators until cool then record the weight of sample after drying.



**Note: this moisture called primary moisture in green roughage**

**Determination of secondary moisture in green roughage** after determination of primary moisture grained the drying sample then take 1-2 gm from it. then determinate the secondary moisture by the same steps of determination of moisture by the same steps of determination of moisture in concentrate diet.

**%dry matter=100-%of moisture**

**B- Determination of moisture in meat :**

1. ****Put clean large basin in oven with 105c for 1hr.
2. Remove the basin from oven into desiccators until cool then records its weight by using electrical balance.
3. Weight 20-25 gram from meat ( cutting into small pieces &put it in large basin).
4. Put the sample in oven **with 105 º C for 3 hrs.**
5. Remove the basin from oven and put it in desiccators until cool then record the weight of sample after drying.



**Types of water in feed:** Water present in feed in 3 types:

1. **Free water**: this water found in vacuums of food matter keeps its physical characteristic it dissolve sugar ,salt ,acid soluble with small molecular weight.
2. **Adsorbed water**: present in very thin layer with one more molecular weight inside and outside the surface of thick matter like starch ,pectein , cellulose and protein.this adsorbed water bond with its by Vander vales forces.
3. **Combined water** :part of this water chemically combined with some compound such as galagtose ,maltose ,lactose and some salts like KNO3, this water called hydration water .

**Note**: the moisture percentage differ in food depend on kinds of foods for example:

