Lecture Title:
Determination of Moisture in Feedstuffs

Subject name: Animal Nutrition

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Determination of Moisture in Feedstuffs

Definition:
Moisture is defined as the free water present in any feedstuff. Moisture can be removed from a feed sample by placing it in an oven. The remaining portion after this process is called **Dry Matter (DM)**.

Importance of Moisture Determination:

1. To prepare feed samples for different chemical analyses, particularly in green or plant feeds.

2. To record results based on the total dry matter content.

3. To preserve feedstuffs, as high moisture levels can lead to fungal growth, rapid deterioration, accelerated chemical reactions, and autolysis of the feed.

Experimental Procedure:

1. An empty, labeled, and clean moisture can is placed in an oven at **100°C for 1 hour**. This step is for cleaning and sterilization.

2. The can is then transferred from the oven to a **desiccator** for cooling.

3. The cooled can is weighed using a **digital electronic scale**, and the weight is recorded.

4. **Sample weighing:**

    o   Weigh 1–2 g of the feed sample intended for moisture estimation and place it in the pre-weighed moisture can.

    o   There are two methods for weighing the sample:
        a. **Combined weight method:** Record the weight of the empty can (e.g., 12 g). Add the sample (e.g., 1.5 g) to get the total weight (13.5 g).
        b. **Tare method (preferred):** Record the empty can weight (12 g). Tare the scale, then add the sample (1.5 g) directly. This method is generally preferred in laboratory practice.

5. Place the moisture can containing the sample in a drying oven at **130–150°C for 30 minutes**.

6. After drying, transfer the can to a **desiccator** for cooling.

7. Weigh the cooled can using the digital scale and record the final weight.

Moisture Determination Calculations

1. **Weight of empty moisture can:** Record the weight of the empty can (W_1).

2. **Weight of moisture can with sample (before drying):** Record this weight (W_2).

3. **Weight of the sample:**

Sample weight=W2−W1

4. **Weight of moisture can with sample (after drying):** Record this weight (W₃).

5. **Weight of moisture lost:**

Moisture weight=W2−W3

6. **Percentage of moisture in the sample:**

$$\frac{weight\ of\ moisture}{weight\ of\ sample} * 100$$

7. **Percentage of dry matter in the sample:**

Dry Matter %=100−Moisture %

Determination of Moisture in Green Feedstuffs Samples

Determination of moisture in green feedstuffs requires a **two-stage drying process**:

Stage 1:

- Take **100–200 g** of feedstuff and chop it.

- Dry the sample at **60–70°C for 16 hours (overnight)**.

- Cool the sample, weigh it, and determine the **primary moisture**.

Stage 2:

- Grind the dried sample finely.

- Take **1–2 g** of the ground sample.

- Estimate the **secondary moisture** following the standard procedures mentioned previously.

Purpose of the Two-Stage Drying:

- To prevent the **formation of a hard outer layer**, which can trap moisture inside and prevent proper drying.

- This ensures that **all moisture is accurately measured**, avoiding underestimation and false results.

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Calculation of Total Moisture:

Total percentage% = primary moisture % + $\dfrac{\textit{secondary moisture}\,(\%)*(\mathbf{100}-\textit{primary moistuer}\,\%)}{\mathbf{100}}$

Dry Matter (%):

Dry Matter %=100−Total Moisture

Example No. (1)

Two hundred grams of green alfalfa feed sample was dried primarily at 60-70 °C for 16 hours. After drying, the weight becomes 40. Two gm. of the primary dried sample was taken and further dried at 150 °C for half an hour to be (1.6gm).

Estimate the primary, secondary, and total percentage of moisture in the sample. Solution:-

Primary moisture % = $\dfrac{\textit{weiht of moisture}}{\textit{weight of sample}} * 100$

$= \dfrac{\text{w,t.of sample before drying}-\text{w.t.of sample after drying}}{\text{weight of sample before drying}} * 100$

$= \dfrac{200-40}{200} * 100 \quad = 80\ \%$

Secondary moisture%=

$= \dfrac{\text{w,t.of sample before drying}-\text{w.t.of sample after drying}}{\text{weight of sample before drying}} * 100$

$= \dfrac{2-1.6}{2} * 100 \quad = 20\ \%$

Total percentage% = primary moisture % + $\dfrac{\textit{secondary moisture}\,(\%)*(\mathbf{100}-\textit{primary moistuer}\,\%)}{\mathbf{100}}$

$= \mathbf{80} + \dfrac{\mathbf{20}*(\mathbf{100-80})}{\mathbf{100}} \quad = \quad \mathbf{84\%}$

4

Example No. (2)

Estimate the percentage of dry matter in a feed sample containing (70%) primary moisture and 5% secondary moisture.

Example No.(3)

The weight of an empty moisture can is 13.5 g; fifteen grams is the weight of the can and the concentrate sample added to the first sample. The sample is put in the oven (130°C) for half an hour. The sample was transferred from the oven and was weighed. The weight became (14.9 g). Estimate the dry matter percentage of the sample.

Determination of Moisture in Milk, Meat, and Egg Samples

The handling of these samples differs from that of ordinary or concentrate feedstuffs because they tend to adhere to the container during the drying process. Therefore, certain substances are added, such as filter paper with milk, sand with meat, and asbestos with eggs. The purpose of using these substances is to:

1. Increase the surface area to enhance evaporation.

2. Prevent the adhesion of the sample to the container.

Experimental Procedure:

1. Weigh the empty moisture can with the added substance (filter paper, sand, or asbestos).

2. Weigh the can with the substance + the sample (this is the *weight before drying*).

3. Calculate the sample weight:

Weight of sample=Weight before drying−Weight of can with substance

Note: The preferred sample weight for meat, eggs, and milk is approximately 5 g.

4. Place the can containing the substance and the sample in a water bath for half an hour.

5. Transfer the can to a drying oven at 150 °C for half an hour. Remove, cool, and weigh it. This is the *weight after drying*.

6. Calculate the weight of moisture:

Weight of moisture=Weight before drying−Weight after drying

7. Calculate the percentage of moisture:

$$\text{Moisture\%} = \frac{\text{Weight of moisture}}{\text{Weight of sample}} \times 100$$

Example:

- Weight of empty can = 11.6 g

- After adding 5 g of dry sand → weight = 16.6 g

- After adding meat sample → weight = 21.45 g (*before drying*)

- After oven drying → weight = 18.76 g (*after drying*)

Solution:

Weight of moisture=21.45−18.76=2.69 g

Weight of sample (meat)=21.45−16.60=4.85 g

$$\text{Moisture\%} = \frac{2.69}{4.85} \times 100 = 55.46\ \%$$