Processing Methods of Animal Feed Stuffs

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Animal Feed technology

It deals with:

- Processing of feeds, fodders
- Preparation of formula feeds for which the knowledge of nutritional requirement of various livestock and poultry
- Quality control of feed ingredients
- Feed plant management
- Storage of feed ingredients and feeds

Defined as:

The application of physical, chemical, biochemical, biological, physiochemical and engineering methods to increase the nutrient utilization of feeds and fodders in animal system
Objective of feed processing

- To make the feed more palatable.
- To detoxify or remove undesirable ingredients.
- To make the storage easy and safe.
- To increase nutrient content and nutrient availability.
- To change the particle size or density of feed.
- To make animal production more economical.
Roughage processing methods

- divided into two groups: based on the addition or deduction of water content of roughages.
  - Dry processing method
  - Wet processing method
Dry processing methods

• In these methods water content is reduced to a desired level.

• Baling:
  ➢ The forage is cut and dried in the field condition.
  ➢ Dried forage is then baled or bundled with Baler
  ➢ By this method we make storage and handling of forage easy and convenient.

• Chopping: It is also known as chaffing:
  ➢ The forages are chopped into small pieces as fine or coarse particles.
  ➢ Chopping avoids the selective feeding thus wastage of plant material is reduced.
  ➢ The machine used for the intended purpose is called chaff cutter.
  ➢ Chopping facilitates easy handling due to increased bulk density
  ➢ also improves digestion due to exposure of relatively large surface area of roughages for microbial digesting
Grinding:
- It is a process of particle size reduction.
- **Course grinding:** roughages improves the feed consumption and growth rate.
- **Fine grinding:** reduce the digestibility of CF: due to faster rate of feed particles in GIT.
- High cost: grinding of roughages is not economical.

Pelleting:
- The ground roughages are pelleted and fed to animals.
- Improves the consumption of poor quality roughages.
- A complete feed: Pelleting poor quality roughage with 30% concentrate.
- The size of pellets is 12/64” to 48/64” and has a density of 40 lb/ cft.
• **Dehydration**:  
  It is a process of reduction of moisture content in a dehydrator using a temp. 600-1500°F for a short time period of 3-5 minutes.

• dehydrated forage: retains: lot of DM and CP  

• No loss of leaves, but carotene content is reduced

• **Cubing**:  
  - It increases the density of roughages upto 30lb/cft.  
  - Good quality hay is sprayed with water to increase the moisture content upto 14%  
  - Broken down rather than to ground the roughage, so that there is minimum of fine particles in the cube.  
  - Cubing: Alfa- alfa hay is done: Developing country
B: Wet processing methods:

- Soaking is a process of mixing or spraying water on roughages so that stems become soft and mixing of concentrates with roughage is uniform which improves the feed intake and digestibility of roughages.

- When green roughages are chaffed, there is no need of soaking and fed as such or mixed with dry roughage or concentrate mixture.
Processing of grains

• divided into two groups:
  • **Wet processing methods**: It includes
    • Grinding
    • Dry rolling,
    • Flaking
    • Pressure cooking
    • Exploding
    • Pelleting
    • Reconstitution
    • Extrusion
    • Gelatinization
  • **Dry processing methods:**
    • grinding, dry rolling, popping, micronizing, extruding and roasting, decorticating /dehulling and crumbling.
Soaking:

- Grains are soaked in water for 6 to 24 hours.
- Soaking softens the grains: swells: palatable
- Soaked grains are easily mixed with roughages and wastage is reduced.
- Soaked cakes of mustard and neem seed cake: are filtered: remove toxic factors

Reconstitution:

- It is similar to soaking water is added to mature dry grain(10%): to raise the moisture content:25 to 30%
- Stored the wet grain in an oxygen limiting silo for 14 to 21 days prior to feeding.
- It also increases the solubility of the grain protein.
Steam rolling:

- **Grain:** Steam: different periods of time depending upon the pressure used prior to rolling.
- At atmospheric pressure, $100^0\text{C}$ temperature and 16-20 % moisture containing grain is steamed for 8 to 20 minutes.
- At pressure of 20 to 60 psi preconditioning, grain having a temperature of 121 to $150^0\text{C}$ and 18-25 % moisture is steamed for a period of 1 to 2 minutes only.
- This only softens the grains without any significant change is starch granules.
- The only advantage of steam rolling over dry rolling is the production of large particles with little fines.
• **Steam flaking:**

  • Steam treatment 15 to 30 min.
  • due to which moisture content in grains rises: to 18-20 %
  • After rolling of such grains, flakes are produced.

• **Process ruptures: starch granules: improves physical texture, nutrient utilization and performance**

• **Pressure cooking and flaking:**

  • grains are first cooked under steam pressure, cooled to room temperature and then rolled.
  • The product is more or less similar to steam flaked grains but the processing is much expensive.
  • Grains are cooked: steam at 50 psi for 1.5 min in air tight chambers, temperature of 300°F.
  • When flakes are made, this temperature is reduced to 200°F and moisture content up to 20% by passing them through cooling and drying tower.
• **Extrusion:**
  A process of cooking in which feeds are also expanded by the application of adequate pressure is known as extrusion.

• **purpose of extrusion:** gelatinization of starch in grains or complete feeds.

• It is also used for the incorporation of urea in starchy feeds

• control of pathogenic microorganisms in feeds of animal source.

• **Exploding:**

• The process of swelling of steam treated grains under high pressure and sudden expose to atmospheric pressure or

• grains are treated with high pressure steam (250 psi) for 20 seconds followed by sudden decrease to atmospheric pressure is known as exploding.

• It is done in steel vessel fitted with valve for injecting steam to raise pressure inside the grain containing vessel to 250 psi for about 20 sec.

• **After that outlet is opened through which treated grains escape in the shape of expanded grains with the husk removed.**

• This happens due to entry of large amount of moisture in the kernels due to high pressure.
• **Pelleting:**
  • The process of densification of a ground grain or composite feed with or without the application of steam or moisture is known as pelting.
  • The ground feed material is forced to pass through the holes of specific size by a mechanical process.
  • The machine used for the purpose: pelleting machine.
  • The purpose of Pelleting is to change dusty and unpalatable feed material into more palatable easy to handle large particles by application of optimum amount of heat, moisture and pressure.
  • Normal size of pellets: 3.9 mm to 19 mm cylindrical shape.
• **Gelatinization:**
  • Complete disintegration of starch granules: by application of moisture, heat and pressure is known as gelatinization.
  • It improves the digestion of feed by increasing water absorption ability and rate of action of amylase on soluble carbohydrates (starches).
Dry processing methods

- **Cracking or dry rolling:**
  - It is the disintegration of kernels into particles with the application of pressure by moving rollers.
  - It is done by a combination of breaking and crushing of the grains.
  - The physical properties of dry rolled or cracked grain would be very similar to that of grains coarsely ground in a hammer mill.

- **Crimping:**
  - The process of rolling of feed ingredients with the use of corrugated rollers is called crimping.
  - The process may include conditioning and cooling of the processed feed.

- **Crumbles:**
  - The feed of granular particle size produced from the grinding of pelleted feeds is called crumbles.
• **Popping/puffing:**
  - It is produced by the action of dry heat (370-425\(^0\)C) for 15-30 seconds causing a sudden expansion of the grain which rupture the endosperm
  - Rupture of starch granules makes the starch more available to digestion
  - About 3% moisture of grain is lost during heat treatment.
  - Popping reduces the density of grains and increases palatability
  - Digestibility of starch improve
  - Popped grains are also a good carrier for molasses.

• **Micronizing:**
  - The popping of grains with the application of infra red heat energy having wavelength of \(3 \times 10^8\) to \(3 \times 10^{11}\) cycles/second is called micronizing.
• **Roasting:**
  - The treatment of grains with direct flame is called roasting.
  - It causes expansion in volume due to heating and generally increases digestibility.
  - Roasting of whole soybeans inactivates enzymes or inhibitory factors which improves the nutritive value for poultry.

• **Grinding:**
  - The process of reduction of feeds into particles with the application of pressure and shearing.
  - It is simplest and least expensive method which is accomplished with the help of hand stone mill, hammer mill and roller mills.
  - The size distribution of grains depends on the shape, size and hardness of the kernel.
Advantages of grinding:

- It is prerequisite for mixing, Pelleting or extrusion.
- It increases the particle number: increase surface area: improve feed utilization
- It avoids selective feeding of grains and reduces the scope of shorting out less palatable feeds by the animals from the compounded mash.
- Grinding increases compactness and reduces space requirement for storage