Various Feed Processing Methods for Improving the Nutritive Value of Inferior Quality Roughages

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Inferior quality roughages

- fibrous crop residues: wheat straw, paddy straw, finger millet straw and barley straw and stovers (kadbi) of sorghum, pearl millet and maize etc.
- Non-conventional dry roughages: sugar cane trash, baggase and fallen tree leaves etc.
- low voluntary intake,
- low digestibility low crude protein essential minerals and vitamins content
- presence of antinutritional factors like lignin silica oxalates and tannins make their utilization inefficient
- poor animal performance low growth rate reduced fertility high mortality and incidence of disease and parasitism.
- So there is a need for quality improvement of dry fibrous crop residues

➢ **Physical treatment**:

- Soaking chopping
- Grinding
- Pelleting
- Wafering
- Steam treatment
- Irradiation.

➢ **Chemical treatment**:

- Alkali treatment
- Ammonia treatment
- Acid treatment

➢ **Biological treatment**:

- Enzyme
- White rot fungi, mushroom and yeast

➢ Chemical treatments:

- The aim of chemical treatment is
- breakdown the lignocelluloses complex
- swelling of cell walls facilitates the easy access of rumen microbial enzymes to the cellulose and hemimellulose
- To increase voluntary intake, digestibility of straw

1. Acid treatment:

- The acid treatment changes the chemical composition to a certain extent without any alteration in the nutrient utilization. Various organic and inorganic acids may be used. But it is cost effective process and have low practical utility.

2. Treatment with oxidizing agents:

- Various oxidizing agents like alkaline hydrogen peroxide, ozone, sulphur oxide, sodium sulphite and bleaching powder are effectively used to nutritional improvement of poor quality roughages

- But due to high cost of treatment and lack of suitable technology for large scale treatment are the main limiting factors for this treatment

3. Alkali treatment:

- **Sodium hydroxide treatment :**
- **Wet treatment:**

➢ The roughage are chopped and treated with 1.5 percent (W/V) NaOH solution for at least 4 hours.

➢ The treated straw was drained and washed with a large quantity of water to remove all the NaOH solution.

- **Dry treatment:**
- chaffed dry fodder is first spread on clean hard floor or thick plastic sheet.
- Solution of NaOH (3-4%) is sprinkled and mixed with fodder.
- 4 to 6 kg of NaOH dissolved in 200 litres of water is adequate to wet 100 kg fodder.
- This makes the fodder moist and has pleasant odour and improved nutritive value.
- care should be taken to protect the skin from NaOH which is corrosive
- cost of NaOH solution increase the cost of treatment: not economical
- During the First World War (1914-18) a product “fodder cellulose” was produced in Germany by treating straw NaOH under high pressure and high temperature.

- **Treatment with lime:**
- calcium oxide and calcium hydroxide are weak alkali, higher amount is required for longer duration for straw treatment.
- It is safe, economical and easily available chemicals than sodium hydroxide.
- **Ammonia treatment:**
- It serves as an alkali to potential rate and extent of digestion of straw and as a source of nitrogen for rumen microbes
- In this treatment stacks of straw were wrapped with polyethylene cover and injected with 3% ammonia. Aqueous ammonia (20-35%) is also used for straw treatment.

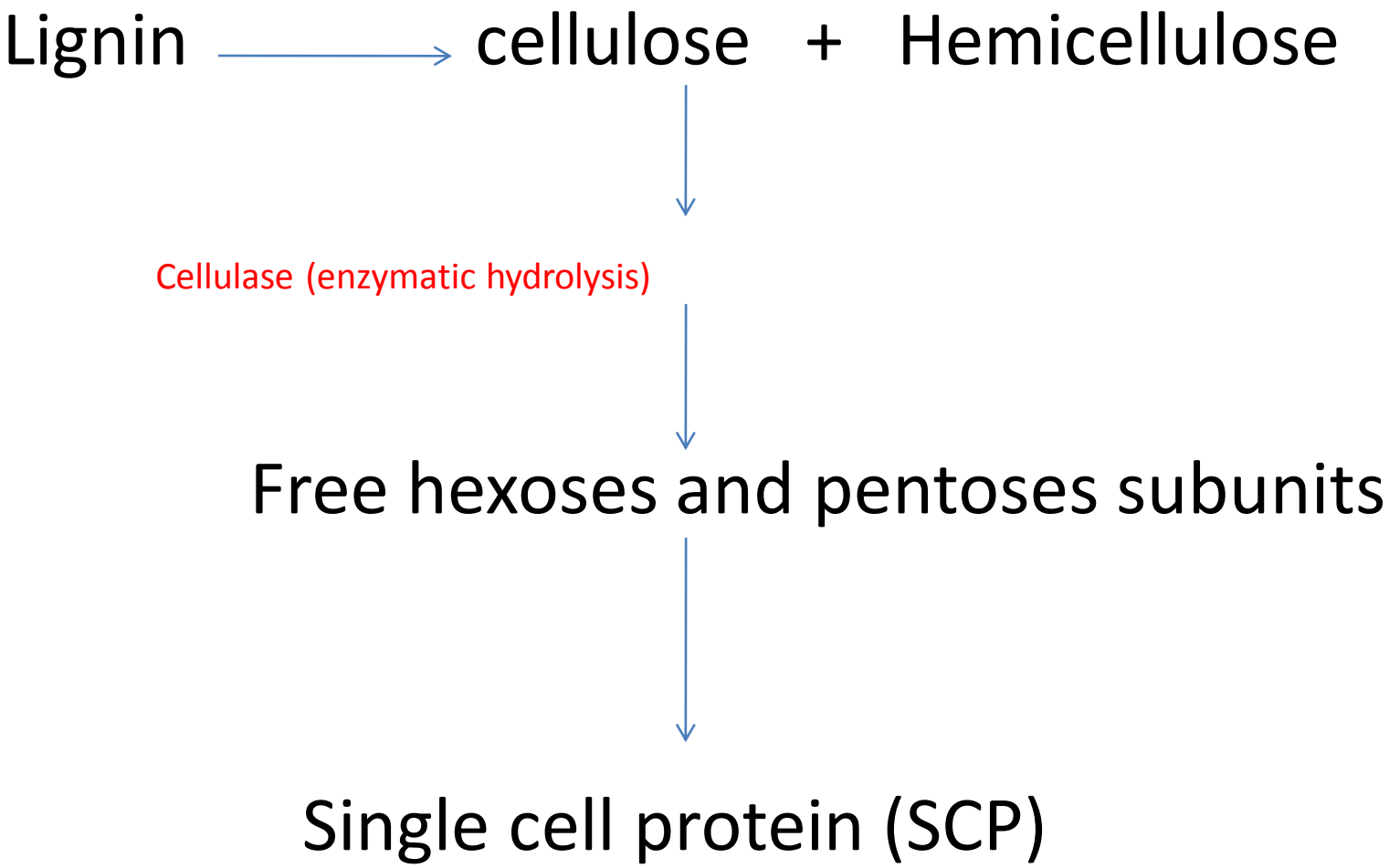
Urea ammoniation treatment:

- It is the most convenient method of chemical treatment to straw.
- Urea is easily available and well knows to farmers.
- weighted chaffed straw is spreads on the polythene sheet in a layer of 45-50 cm
- 3 kg urea is dissolved in 40 litres of water for 100 kg straw.
- **Conditions for urea treatment:**
- **Moisture leaves** :
- 35-40 litres of water for 100 kg roughages is sufficient for ureolysis.
- **Temperature** :
- The optimum temperature for urease activity in soil is 30^0C. Ammoniation is increased at higher temperature.
- **Level of urea :**
- Optimum level of urea should be used for better utilization well as to avoid toxicity of urea.
- 4-5 percent urea (V/V) solution may be used.
- Urease enzyme is a natural contaminant of straw. Urea was extensively hydrolysed by this enzyme.
- But addition of an urease source reduces the treatment time.
- Soyabean powder (8.5%) is an urease source.

- **Treatment with animal urine:**
- Animal urine an unconventional NPN source abundantly available is also used to improve the nutritive value of poor quality roughages.
- **Precautions for chemical treatments:**
- Mixing of the chemicals should be thorough and uniform
- Chemicals should be handled carefully as these are corrosive in nature.
- Ammonia is an explosive in nature so fire should not be ignited near the stock or during the injection of ammonia gas.
- Ammoniated fodders should be properly aerated before feeding to the animals.
- Animals should be adapted to chemical treated roughages by feeding low concentrated chemical treated roughages initially.

- **C. Biological treatment :**
- Biological treatments involves the living organisms specially microbes (Fungi) to improve the nutritive value of poor quality roughages.
- In this treatment poor quality straws are treated with aerobic fungi namely white rot fungi such as *Sporotrichum* sp., *Lenzitis Coprinus* sp. *Treichusus spiralis*, *Pacilomyces fusisporus* etc.
- Pure culture of fungus strain are raised on suitable medium and then incubated with straw at varying moisture level for different periods, which will improve the nutritive value of straw.

- Most microorganisms: should have the ability to break down the lingo-cellulose complex and degradation of lignin and cellulose with their enzyme secretion.
- So that digestibility of these cell wall components may improve.
- The ideal microorganisms for biological treatment should have strong lignin metabolism with low or no affinity towards cellulose and hemicelluloses.
- The biological methods of straw treatment which involves the use of microorganism capable of degrading lignin by producing extra cellular “Phenol oxidase” the enzyme which are probable involves in the process of lignin degradation and thus rendering cellulose and hemicelluloses fraction free.
- A high activity cellulose is required for enzymatic hydrolysis of cellulose.


Lignin
cellulose + Hemicellulose
Cellulase (enzymatic hydrolysis)
Free hexoses and pentoses subunits
Single cell protein (SCP)

- Free hexoses and pentoses subunits are used for single cell protein.
- Best results of Biological treatment are obtained when the roughage incubated with fungal spore for the period of at least 30 days.
- But care should be taken that these microbes should not produce toxins, easy to handle and cost effective.
- Thus, these methods have great appeal as an alternative to the use of expensive chemical and physical methods to produce economic ruminant feeds.