FOOD STORAGE ENGINEERING
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3 CREDIT

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What is Storage?

- **Storage** is the keeping the quality of food materials

- preventing them from deterioration for specific period of time, beyond their normal shelf life.

- important marketing function involving holding and preserving foods from the time they are produced until they are needed for consumption.

• allows food to be eaten for some time (typically weeks to months) after harvest rather than solely immediately.

• both a traditional domestic skill and, in the form of food logistics, an important industrial and commercial activity.

• food preservation, storage, and transport, including timely delivery to consumers

• important to food security, especially for the majority of people

• throughout the world who rely on others to produce their food.

• stored by almost every human society and by many animals.

Reasons For Storage

- The storage of foods, therefore, from the time of production to the time of consumption
- Ensures a continuous flow of foods in the market.
- Protects the quality of perishable and semi-perishable products from deterioration.
- Some of the farm products, have a seasonal demand.
- To cope with this demand, production on a continuous basis and storage become necessary.
- Helps in the stabilization of prices by adjusting demand and supply.
- Necessary for some period for performance of other marketing functions.
- Provides employment and income through price advantages.

Storage principles

- Follow the rule First in First out
- Keep potentially hazardous foods out of the temperature danger zone 4.4-60^{0}C
- Keep all goods in clean, undamaged wrappers or packages
- Keep storage areas clean and dry
- Keep vehicles for transporting food with in the establishment clean.


FIRST IN
(Newest
FIFO
FIRST OUT
(Oldest)

WHICH TYPES OF FOOD WILL YOU STORE?

Perishable

Semi-Perishable

Non-Perishable

CLASSIFICATION OF FOOD BASED ON PERISHABILITY

- Some foods have longer shelf life than others.
- Perishability refers to the quickness with which a food gets spoilt.
- Foods can be classified into three groups depending on how long they can be kept without any treatment.
  - **Perishable**
  - **Semi-Perishable**
  - **Non-Perishable**

PERISHABLE FOODS

- **Perishable** foods can be kept at room temperature for only few hours or 1 or 2 days before spoiling.
- For example- milk and milk products, meat, fish, poultry, fruits, leafy vegetables and cooked food.
- These foods keep well under refrigeration.
- Perishable foods contain a high amount of moisture and free water.
- These foods contain more than 50% moisture like milk, juices etc.
- In general, the most perishable foods contain a high level of protein or have moisture and carbohydrates in them.
- Special methods are used to preserve such foods.
- The rate of spoilage varies with the temperature, moisture and or dryness of the environment.
- These foods can be maximally having the shelf life of one week.

SEMI -PERISHABLE

- **Semi -perishable** foods can be stored for a couple of weeks or even a month or two without any detectable signs of spoilage.
- Temperature and humidity of the environment again affects the shelf stability.
- Proper handling and storage can result in fairly long storage without spoilage.
- Examples:
  - All cereal and pulse products like wheat flour, broken wheat, Bengal gram flour,
  - Fruits like citrus fruits, apples,
  - Vegetables like pumpkin, roots and tubers, yams, potatoes, onions, garlic etc.
- Semi-perishable foods contain moisture more than stable food and less than perishable foods. These items contain about 25-50% moisture content.
- Semi-perishable foods have the shelf life of maximum to two months to six months if handled carefully.

NON- PERISHABLE/ STABLE FOOD

- **Non- perishable** foods will keep for months or years without spoiling unless handled and stored carelessly.
- Examples of such foods are all preserved food products (canned, dried, pickled etc.), whole cereal, pulse and millet grains, oil seeds, nuts, fats and oils, honey, sugar, jaggery, salt, some spices and essence.
- Food items contain 15% or less than that moisture content.
- Microorganisms require water for their growth. Mold and yeast can grow at low water content.
- But these food items contain very less moisture or very less free water for the growth of microorganisms.
- Stable foods have the longest shelf life from one year to five years.
- This variation in shelf life is due to the structure of food.
- Some foods have complex structures that will not allow food to spoil. Microbes cannot penetrate into such foods. These foods include wheat and other cereals at most.

PRINCIPLES OF PRESERVATION

In the preservation of foods by various methods, the following principles are involved:

1. Prevention or delay of microbial decomposition
   - By keeping out microorganism (Asepsis)
   - By removal of microorganism (Filtration)
   - By hindering the growth and activity of microorganism (Low temperature, drying, anaerobic conditions, chemicals)
   - By killing the microorganism (Heat of radiation)
2. Prevention or delay the self-decomposition of the food
   - By destruction or inactivation of enzymes (Blanching)
   - By prevention or delay of chemical reactions (prevention of oxidation by antioxidant)
3. Prevent the damage cause by insects, animals, mechanical causes etc.

Classification

STORAGE TYPES: CLASSIFICATIONS

- Classification of storage types can be based on the following factors:
  - Duration of Storage
  - Size or Scale of Storage
  - Principle of Storage

CLASSIFICATION BASED ON DURATION OF STORAGE

- Storage systems are classified in terms of duration of storage as:
  - Short Term Storage
  - Medium Term Storage
  - Long Term Storage

STORAGE TYPES (CONTD.): SHORT TERM STORAGE

- Stored products in short term storage mostly do not last beyond 6 months
- Highly perishable products (such as egg, meat, fish and dairy products) are naturally stored for short term
- High loss of quality is associated with highly perishable crops in this storage except controlled systems are used.

STORAGE TYPES (CONTD.): MEDIUM TERM STORAGE

- Medium term storage involves keeping the quality of stored products without appreciable deteriorations for up to 12 months
- The quality of such stored products may not be guaranteed after 18 months

STORAGE TYPES (CONTD.): LONG TERM STORAGE

- Long term storage can guarantee the quality of stored products beyond 5 years
- Germ banks and
- some storage systems are known to preserve viability and proximate characteristics of stored materials for decades.

CLASSIFICATION BASED ON SIZE OR SCALE OF STORAGE

- Storage systems are classified in terms of size or scale of storage as:
  - Small Scale Storage
  - Medium Scale Storage
  - Large Scale Storage

STORAGE TYPES (CONTD.): SMALL SCALE STORAGE

- Small scale storage systems have capacity for up to 1 ton, but not beyond
- They are mostly used at domestic and peasant levels
- They are associated with peasant farmers with small farm holdings.

STORAGE TYPES (CONTD.): MEDIUM SCALE STORAGE

- Medium scale storage can accommodate up to a hundred tons of stored products.
- Most of such storage systems are in the capacity range of 2 – 50 tons, with very few having capacity beyond 50 tons.
- Some are used in breweries for temporary storage of spent grains

STORAGE TYPES (CONTD.): LARGE SCALE STORAGE

- Large scale storage can accommodated stored material in 100s and1000s of tons
- It is used either for temporary or permanent storage of very large quantity of various products
- It has a very high initial cost but eventually reduces overall unit cost of production.

STORAGE TYPES (CONTD.): CLASSIFICATION BASED ON PRINCIPLE OF STORAGE

- Storage systems can be classified in terms of principle of operation. These include:
  - Physical Storage
  - Chemical Storage
  - Biological Storage

STORAGE TYPES (CONTD.): PHYSICAL STORAGE

- Physical storage utilizes physical principles to achieve storage and preservation the quality of stored products.

- The physical environment (in terms of moisture content, temperature and relative humidity) within the storage system is mostly controlled or manipulated to retard the activities of agents of deterioration or prevent deterioration.

- Example: cold storage or controlled environment

STORAGE TYPES (CONTD.): CHEMICAL STORAGE

- Chemical storage utilizes chemicals to stop or retard the activities of agents of deterioration.
- The use of chemicals such as wax, actellic, or phosphosene dust or tablet to prevent respiration or insect infestation in stored produce.
- Some chemicals are however poisonous and their uses must be highly monitored, e.g. phosphosene


Actellic 25 EC
syngenta

STORAGE TYPES (CONTD.): BIOLOGICAL STORAGE

- Biological storage utilizes biological agents, especially micro organism, to stop or retard the activities of agents of deterioration or enhance the shelf life of stored products
- This is a very good area of the application of bio-technology in agriculture

- Give some example ???? (biological agents are using in storage system)

THANK YOU

ANY QUESTION??