

Evaporation: Definition Factors affecting evaporation

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Definition of Evaporation

- Evaporation is the process of removal of solvent from the solution by boiling the liquid in a suitable vessel and withdrawing the vapour, leaving a concentrated product.
- **Applications of Evaporation**
 1. Evaporation process is used in the manufacture of bulk drugs, particularly in pharmaceutical industries.
 2. Evaporation is used in the manufacture of biological products. e.g. Insulin, enzymes and hormones.
 3. In demineralization of water.

Factors affecting Evaporation

1. Temperature
2. Temperature and time of evaporation
3. Temperature and moisture content
4. Types of product required
5. Effect of concentration
6. Surface area
7. Vapour pressure of the liquid to be evaporated

Factors Affecting Evaporation

The following are the factors which affect the rate of evaporation of a liquid:

1. Temperature : The rate of evaporation is directly proportional to the temperature of the liquid. The evaporation can be accelerated by increasing the temperature but it will cause decomposition of heat sensitive principles of many drugs. Many glycosides and alkaloids are decomposed at a temperature below 100°C . Hormones, vitamins, enzymes and antibiotics being more heat-sensitive materials, needs special treatment in order to avoid decomposition *e.g.* Malt extract is concentrated by evaporation under their reduced pressure to avoid loss of enzyme.

2. Temperature and time of evaporation : It has been observed that exposure to a relatively high temperature for a short period of time may be less harmful to the active principles of a drug than a lower temperature with exposure for a longer period. On the basis of this fact, liquid is exposed to high temperature for a short period in film evaporator.

3. Temperature and moisture content : Some drug constituents decompose more readily in the presence of moisture if heated at a high temperature. This is due to the hydrolysis of the active constituents.

To avoid decomposition of the active principles of such materials the evaporation is done at a low temperature and then the final drying is done at a high temperature when only little moisture remains in it.

4. Types of product required : On evaporation of the liquid the concentrated liquid, semisolid and solid are formed. The selection of the method and the equipment required for evaporation depends upon the type of the product required.

5. Effect of concentration : During evaporation the upper layer of the liquid under evaporation has a tendency to form a film and formation of precipitate in the product which results in lowering down of the rate of evaporation. Therefore, efficient stirring is required in order to prevent degradation of the product at the bottom due to excessive heat and it will also prevent deposition of solids.

6. Surface area : The rate of evaporation is directly proportional to the surface area of the evaporator, in which the liquid is evaporated. The larger the surface area of the evaporator, the shorter is the time it takes to evaporate the liquid.

7. Vapour pressure of the liquid to be evaporated : The rate of evaporation is directly proportional to the vapour pressure of the evaporating liquid. The liquid has the maximum vapour pressure at its boiling point. As such the rate of evaporation can be increased by raising the temperature of the evaporating liquid. The rate of evaporation of liquid is the maximum at its boiling point.

Classification of Evaporation Equipment

I. Natural circulation evaporators

1. Evaporating pans
2. Evaporating still
3. Short tube evaporators

II. Forced circulation evaporators

III. Film evaporators

1. Climbing film evaporators
2. Horizontal film evaporators

THANK YOU 😊