DRYING

Lab -5-

Drying

Drying

- Drying :- is the removal of liquid from material by application of heat.

It is accomplished by

- transfer of a liquid from a surface into an unsaturated vapor phase.

Purposes of drying:

1- Unit of process in pharmaceutical manufacturing

(e.g. preparation of granules then dispense as capsules or tablets).

2- Reduce bulk and weight → lower the cost of transportation and storage.

3- Aid in preservation of animal and vegetable drugs by minimizing mold and bacterial growth in moisture laden material

4- facilitate comminution by increasing friability.

Classification of solids on drying behavior

- 1- **Granular or crystalline solids** (water is held in shallow and open surface pores as well as in interstitial spaces between particles that are easily accessible to the surface).
- **Ex: calcium sulfate, zinc oxide, magnesium oxide**

- 2- **Amorphous, fibrous or gelatinous solids** (moisture is an integral part of the molecular structure as well as being physically entrapped in fine capillaries and small interior pores).
- **Ex: starch, insulin and aluminum hydroxide.**

Note: Amorphous solids are difficult to dry than granular or crystalline solids.

Classification of dryers

1- Static-bed dryers-systems

A- tray and truck dryers

B- tunnel and conveyor dryer

C-oven

2- moving-bed dryers-systems

A. turbo-tray dryer

B. pan dryer

3- fluidized - bed dryers systems

4- pneumatic dryers system

5- specialized drying methods

A- Freeze dryer

B- microwave drying

1- Static-bed dryers- systems

- **A- tray and truck dryers:** *it consist from cabinet in which the material dried is spread on tiers of trays .*

1- Static-bed dryers- systems

- ***B- tunnel and conveyor dryer:*** *an adaptation of truck dryer for continuous drying.*

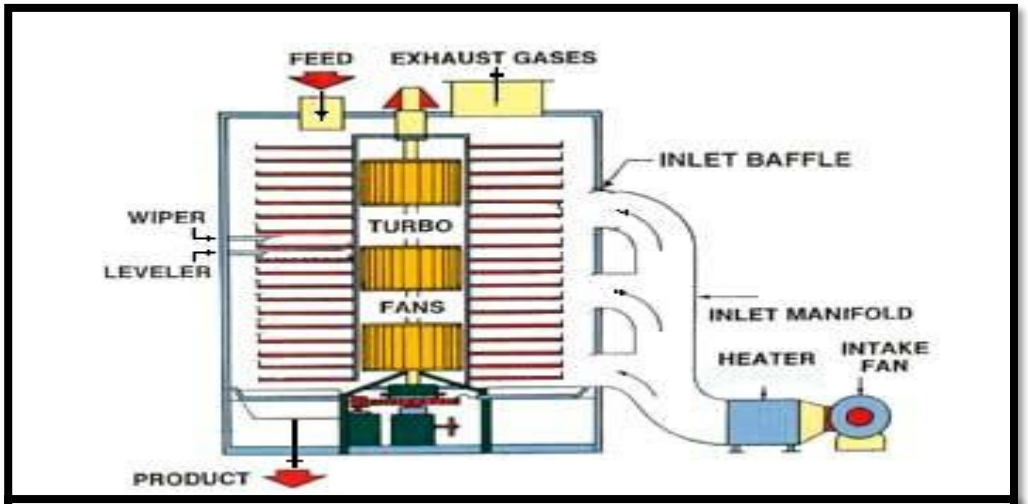
1- Static-bed dryers- systems

- **C- oven:** *including autoclave and dry oven*

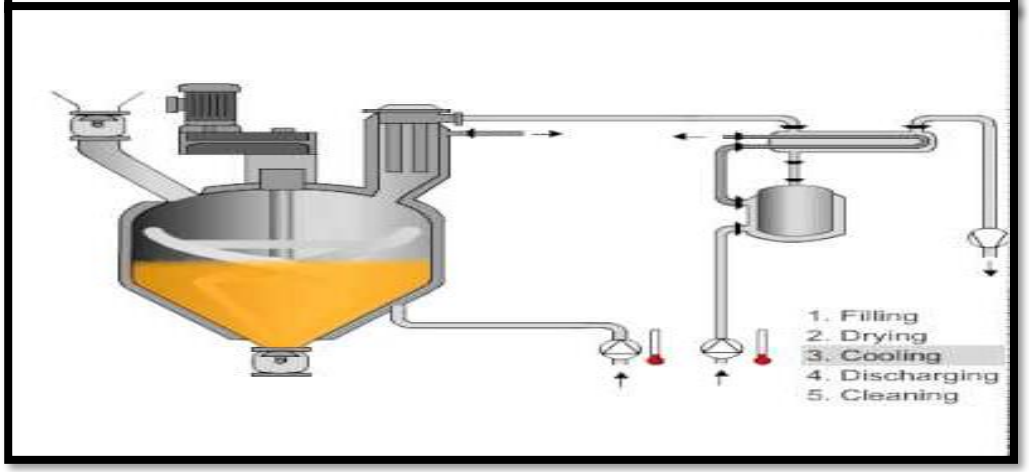
2- moving-bed dryers-systems

- *The drying particles are partially separated so that they flow over each other.*

- **A. turbo-tray dryer**

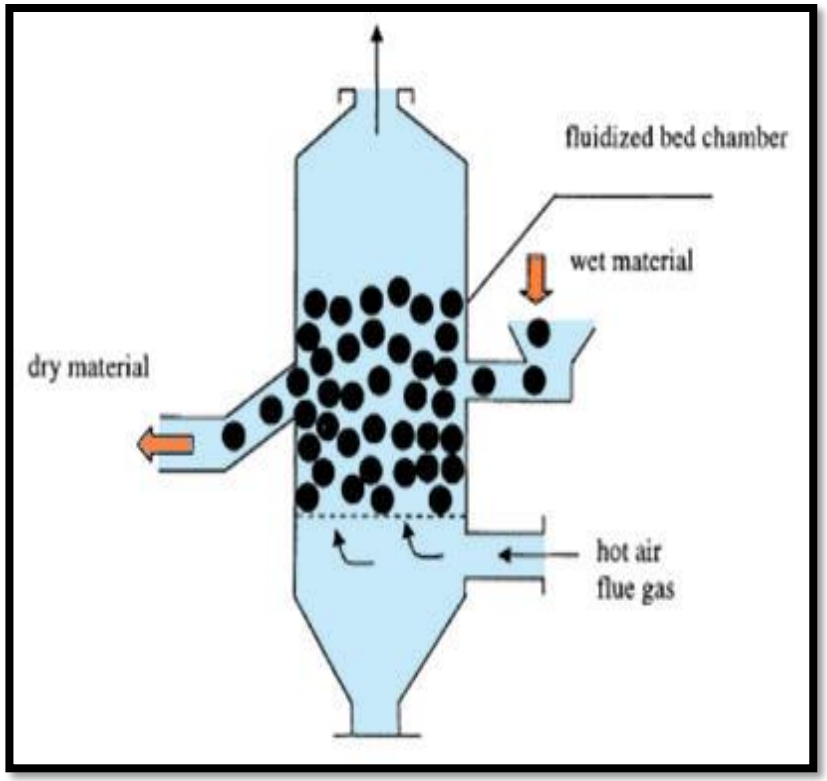


- **B. pan dryer**



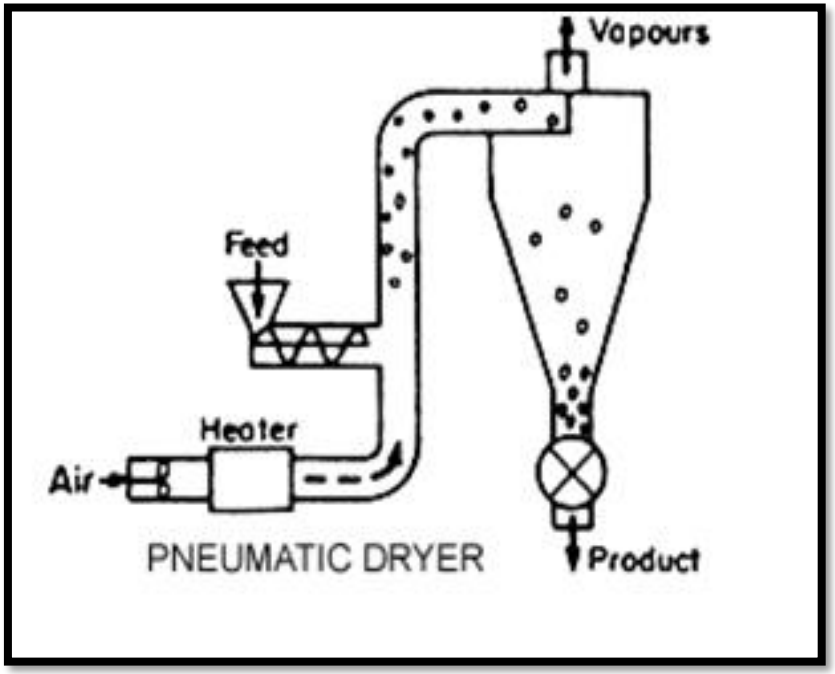
3- fluidized - bed dryers systems

- *Solid particles are partially suspended in upward moving gas steam.*



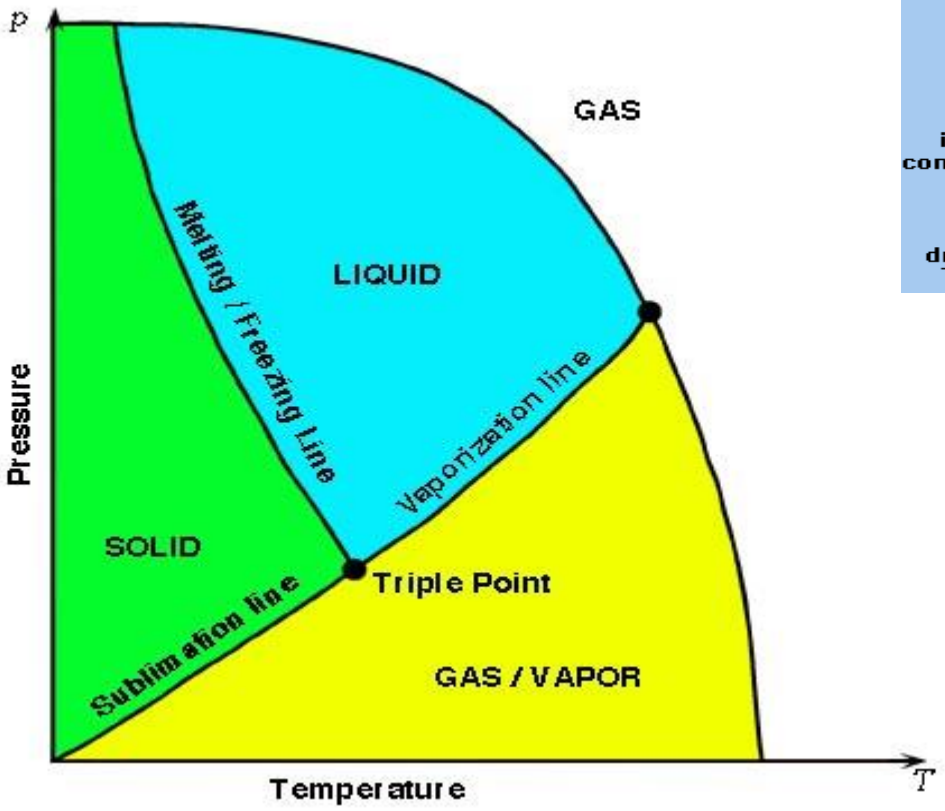
4- pneumatic dryers system

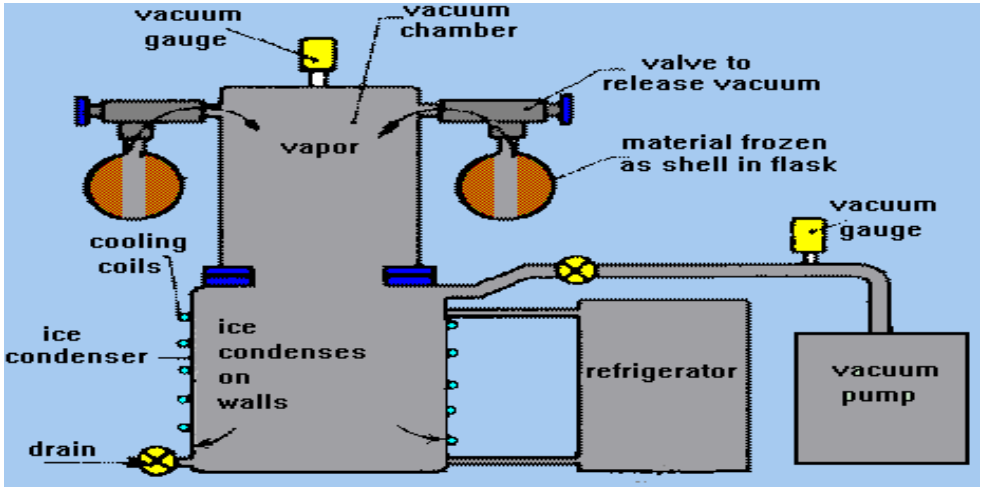
- *Drying particles are entrained and conveyed in a high velocity gas stream.*



5- specialized drying methods

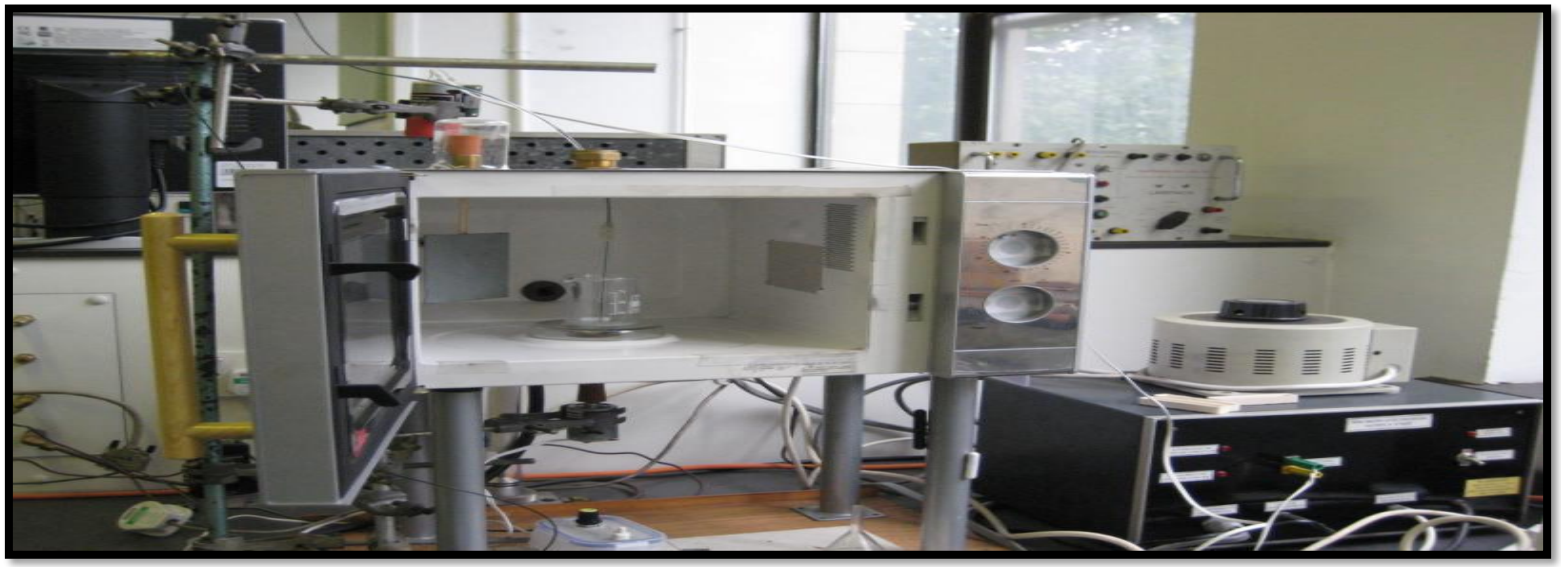
- *A- Freeze dryer*





5- specialized drying methods

- ***B- Microwave drying:-*** here instead of applying heat externally to material, energy in form of microwaves is converted into internal heat by interaction with material itself



Solids drying

The moisture in a solid can be expressed on a **wet-weight** or **dry-weight** basis.

Wet-weight basis: loss on drying

$$\%LOD = \frac{\text{wt. of water in sample}}{\text{total wt. of wet sample}} \times 100$$

Dry-weight basis: moisture content

$$\%MC = \frac{\text{wt. of water in sample}}{\text{wt. of dry sample}} \times 100$$

Example

If exactly 7 g of moist solid is brought to a constant dry weight of 5 g:

- $MC = \frac{7-5}{5} \times 100 = 40\%$

Whereas

- $LOD = \frac{7-5}{7} \times 100 = 28.57\%$


thank
you