

# **Tray dryer & Drum Dryer**

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# List of equipments used for drying:

- ▶ Drum dryer,
- ▶ Spray dryer,
- ▶ Fluidised bed dryer,
- ▶ Tray dryer,
- ▶ Tunnel dryer,
- ▶ Vacuum dryer,
- ▶ Microwave,
- ▶ Radiant heat dryer (infra red)
- ▶ Rotary dryer
- ▶ Freeze dryer

# Drum dryer/Roller dryer/ Film dryer:

## Principle:

- In drum dryer heated hollow cylindrical drum is rotate on longitudinal axis, which is dipped into the solution to be dried.
- The solution is carried as a film on the surface of the dryer and dried to form a layer. Dried material is removed with the help of the knife.

## ▶ Construction:

- ✓ It consist of horizontally mounted **hollow steel drum** of **0.6 to 3m diameter** and **0.6 to 4m length**.
- ✓ Below the drum **feed pan** is placed in such a way that the drum dips partially into the feed.
- ✓ One side of the drum **spreader** and other side **knife** is placed.
- ✓ **Storage bin** is placed to collect the material

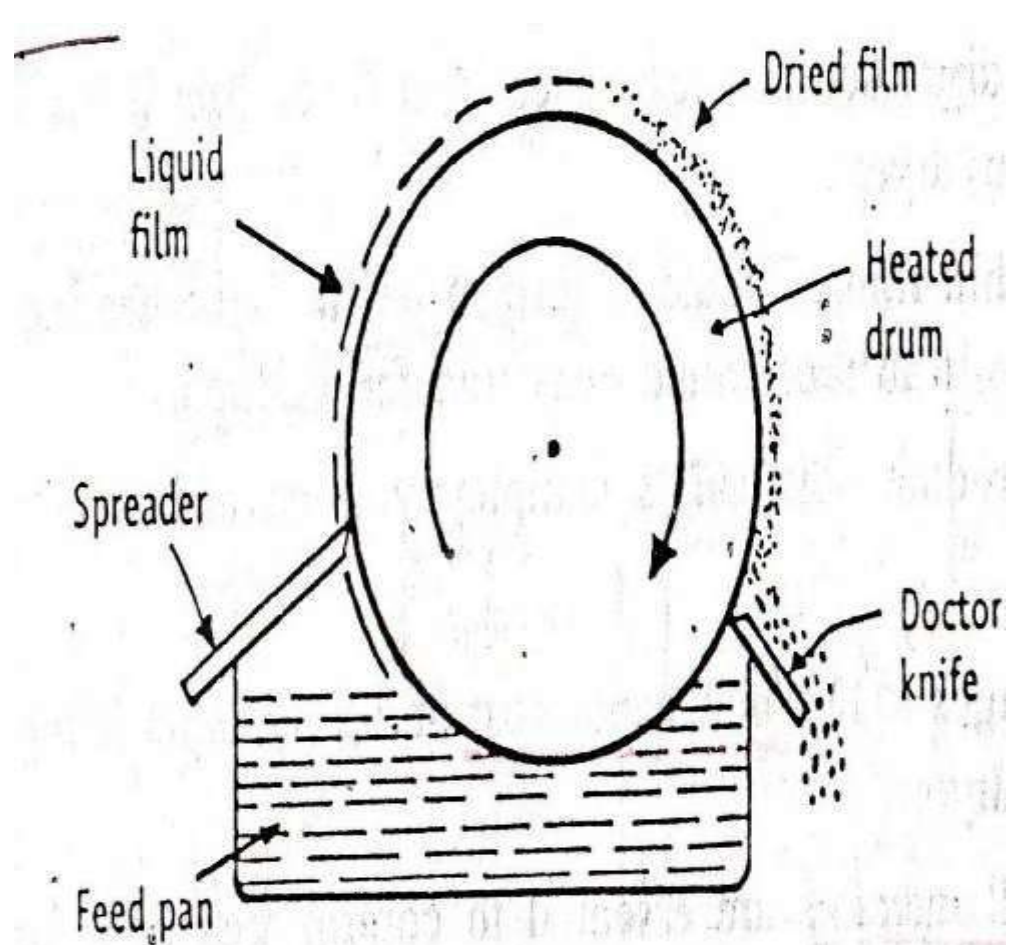


Figure 14-4. Drum dryer.

▶ **Working:**

Steam is passed inside the drum

Drum is rotated at 1–10 rotations per minute

The liquid present in feed pan adheres to the surface of drum.

Material is dried during the rotation of drum and collected in storage bin by using knife.

**Note:** Drying process in drum dryer completes in less than one cycle so the time of contact of material with drum is only 6 to 15 seconds



**Uses :** Drum dryer is used for drying solutions, slurries, suspensions etc. The products dried are milk products, starch products, ferrous salts, suspensions of zinc oxide, suspension of kaolin, yeast, pigments, malt extracts, antibiotics, glandular extracts, insecticides, DDT, calcium and barium carbonates.

- Advantages :**
- (1) In drum dryer, drying time is less, only a few seconds. Therefore, heat sensitive materials can be dried.
  - (2) Drum dryer occupies less space, as it is compact when compared to spray dryer.
  - (3) As a thin film of liquid is formed on the large heating surface, rates of heat transfer and mass transfer are high.
  - (4) The product obtained is completely dried and is in the final form.

- Disadvantages :**
- (1) Maintenance cost of a drum dryer is higher than spray dryer.
  - (2) Skilled operators are essential to control feed rate, film thickness, speed of rotation and temperature.
  - (3) It is not suitable for solutions of salts with less solubility.

# Tray dryer:

- ▶ **Principle:**

In tray dryer hot air is continuously passed over wet mass. Heat transfer takes place by forced convection.

- ▶ **Construction:**

It consist of **rectangular chamber** whose wall is insulated. **Trays** are placed in the chamber according to need.

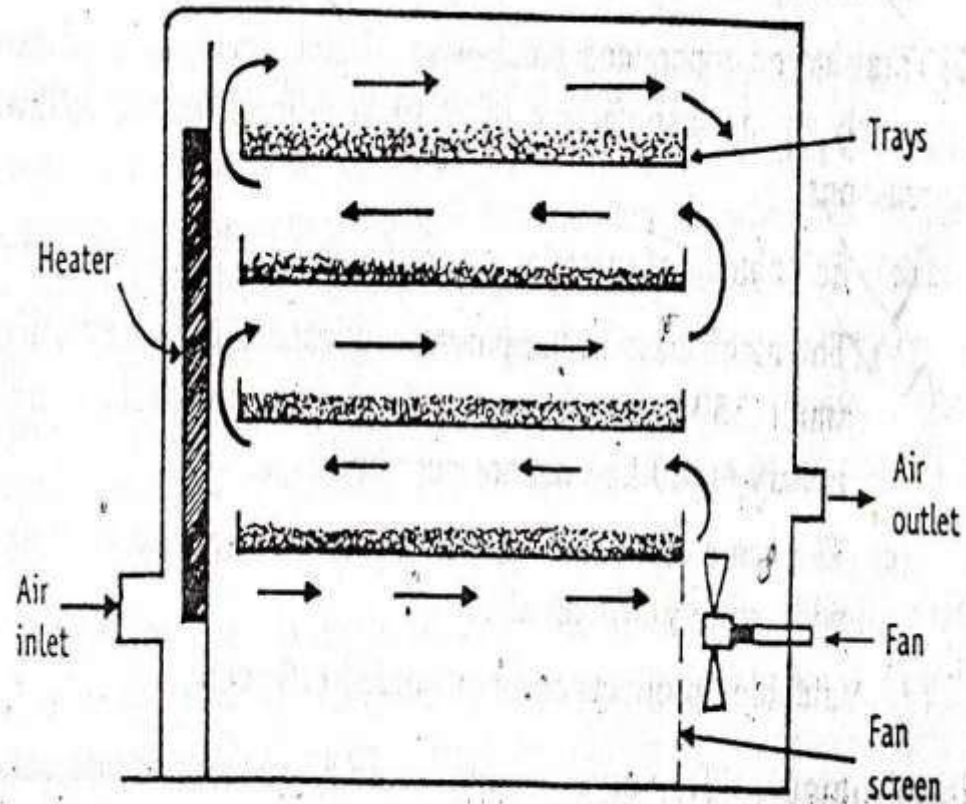



Figure 14-3. Tray dryer.

- Laboratory dryers contains 3 trays minimum and in industry 20 tray. Each tray is rectangular or square and about 1.2 to 2.4 m<sup>2</sup> in area.
  - Dryer is fitted with a fan for circulating air over the trays.
  - Electrically heated elements are provided inside to heat the air.
  - Air temperature is thermostatically controlled between 40 to 120°C.
- 



Improved handling\*



## Working:

- ✓ Wet solid is loaded into trays. Trays are placed in the chamber.
- ✓ Fresh air is introduced through inlet which passes through the heaters and heated up.
- ✓ The hot air is circulated by means of fans at 2 to 5 meter per second.
- ✓ The water is picked up by air and moist air is removed from outlet.
- ✓ During the cycle of drying only 10 to 20 % of fresh air is introduced and 80 to 90% air is circulated back.

✓ **Uses :** Sticky materials, plastic substances, granular mass or crystalline materials, precipitates and pastes can be dried in a tray dryer. Crude drugs, chemicals, powders, tablet granules or parts of equipment are dried.

✓ **Advantages :** (1) In tray dryer, handling of materials (loading and unloading) can be done without losses.

✓ (2) Tray dryer is operated batch-wise. Batch drying is used extensively in the manufacture of pharmaceuticals for the following reasons.

- ✓ (a) Each batch of material can be handled as a separate entity.
- ✓ (b) The batch sizes in the pharmaceutical industry are relatively small (250 kg or less per batch) compared with the chemical industry (1000 kg or more per hour).
- (c) The same equipment is readily adjusted for use in drying a wide variety of materials.
- (d) Valuable products can be handled efficiently.

✓ **Disadvantages :** Tray dryer requires more labour to load and unload. Hence, cost increases. The process is time consuming.



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