



# Spray Drying of Milk

## Part 2

LPT-610  
Unit 1

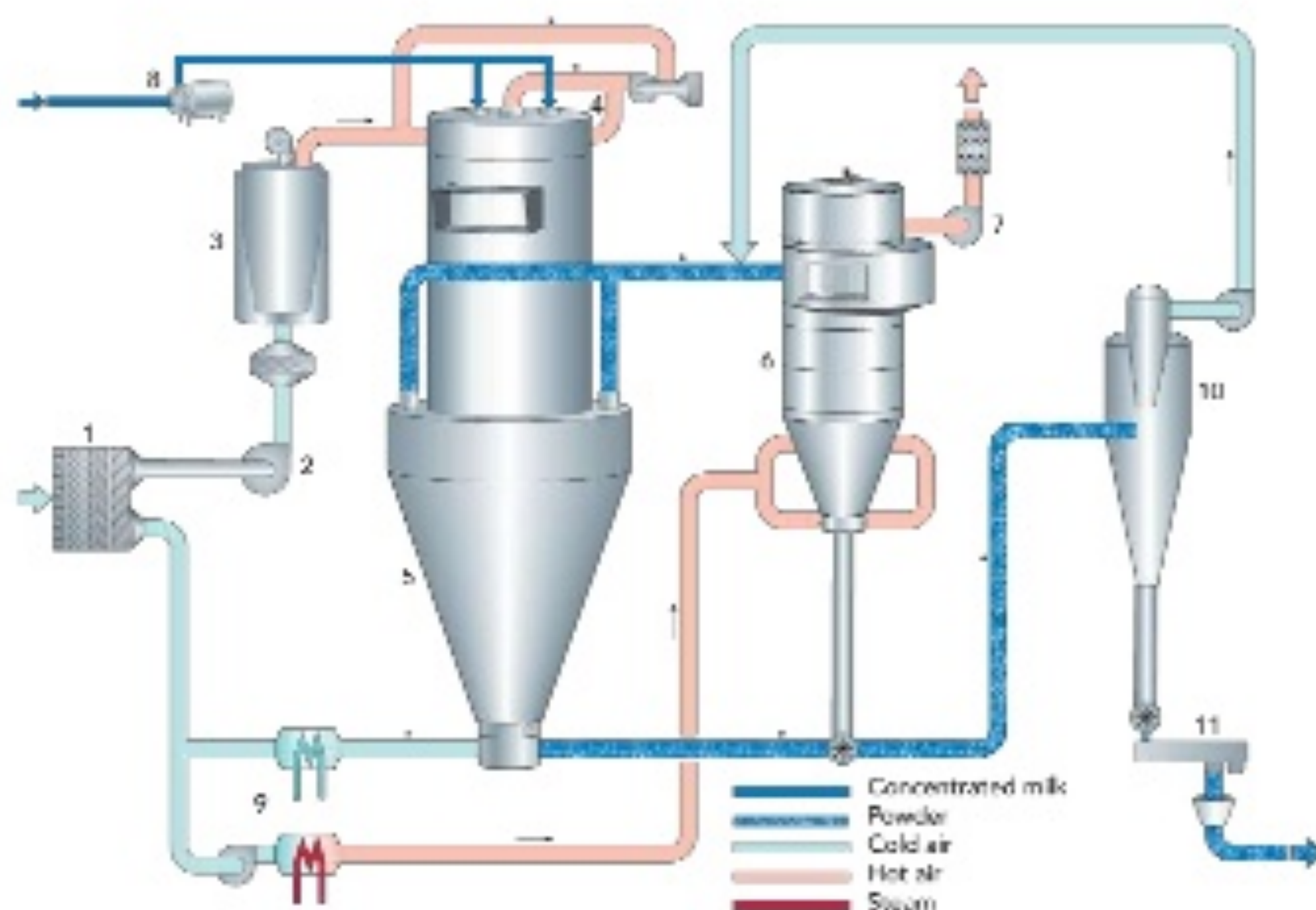
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## SINGLE-STAGE DRYING

1. Inlet filter
2. Inlet fan
3. Air heater
4. Air distributor
5. Drying chamber
6. Bag filter
7. Exhaust fan
8. High pressure pump
9. Fluid bed
10. Air handling units
11. Cyclone
12. Powder sifter





# Types

1. Method of atomising spray material.
2. Method of furnishing heat.
3. Method of heating air.
4. Position of drying chamber.
5. Number of drying chambers.
6. Direction of air-flow.
7. Pressure in drier.
8. Method of separation of powder from air.





# Types contd..

9. Treatment & movement of air.
10. Removal of powder from drying chamber.
11. Method of heat transfer.
12. Drying chamber atmosphere.
13. Position of fan.
14. Shape of drying chamber.
15. Product being dried.





# **Method of atomising spray material**

**Pressure Spray Nozzle/ Hydraulic Pressure Jet**

**Compressed Air Spray / Pneumatic Spray**

**Centrifugal Spinning Disc**

# Method of furnishing heat

**Steam**

**Gas**

**Fuel Oil**

**Electricity**

# Method of heating air

**Direct (Gas/Fuel)**

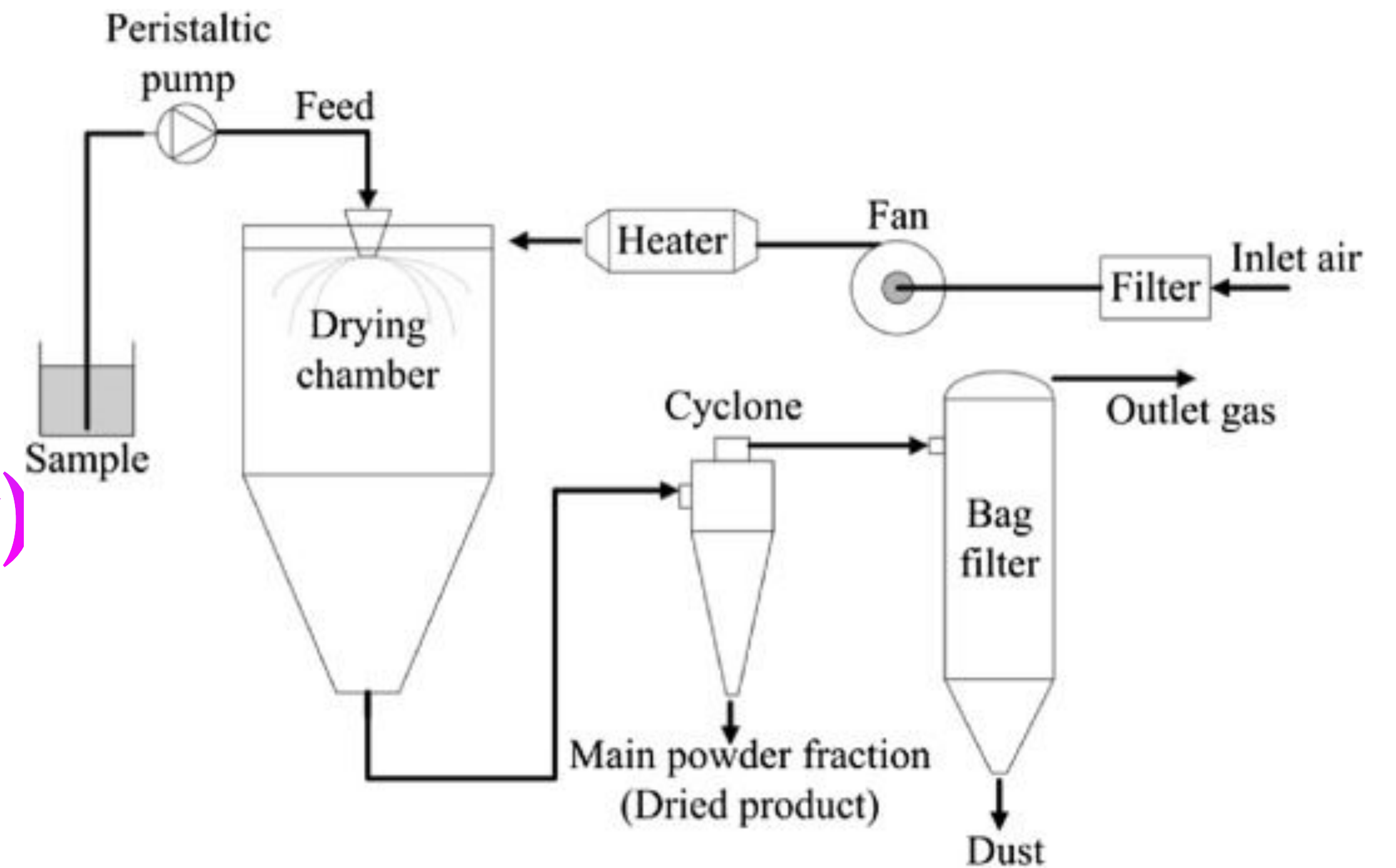
**Indirect (Heat exchanger plate/coil)**



# Number of drying chambers

**One (main only)**

**Multiple (main and subsidiary)**

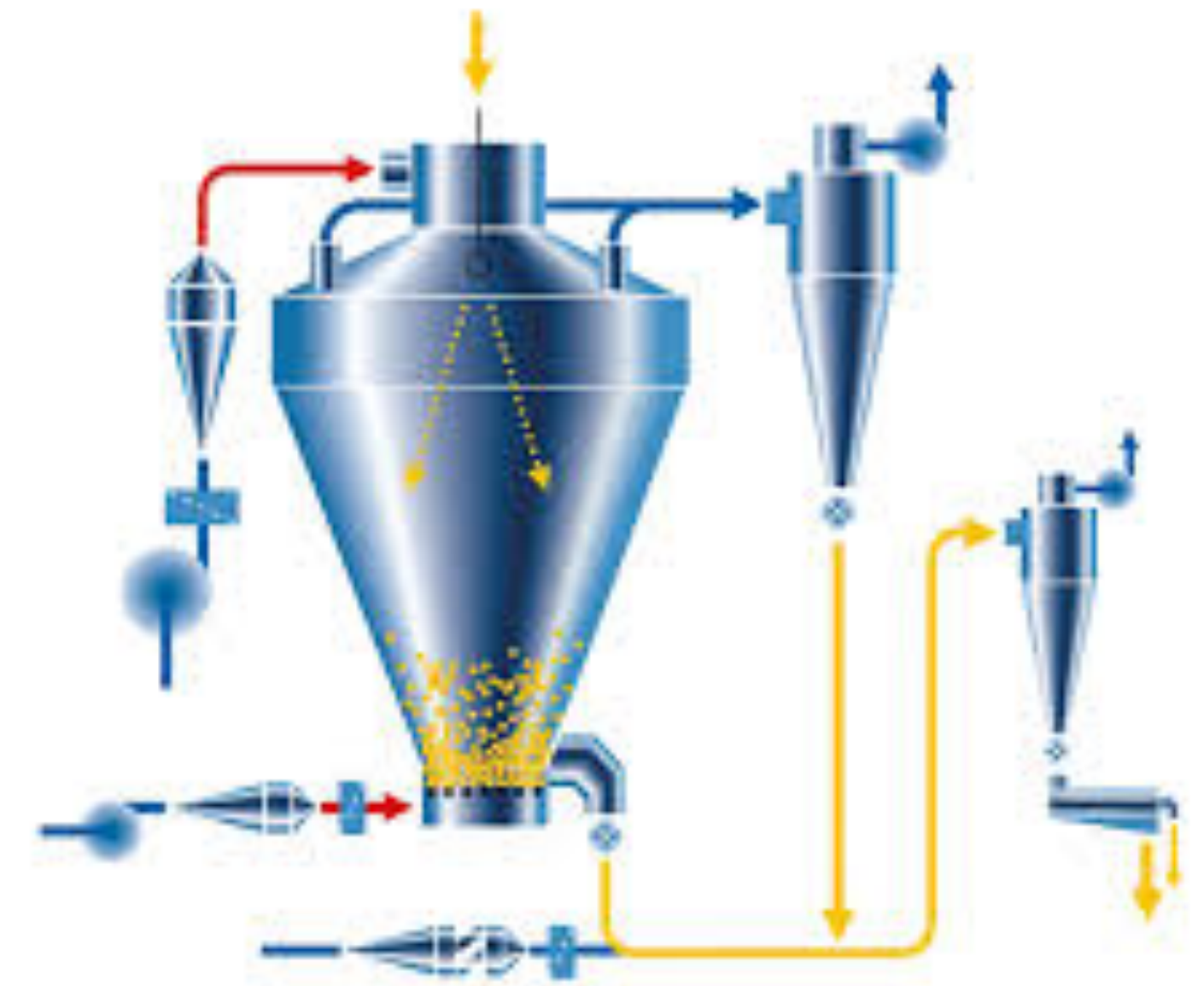
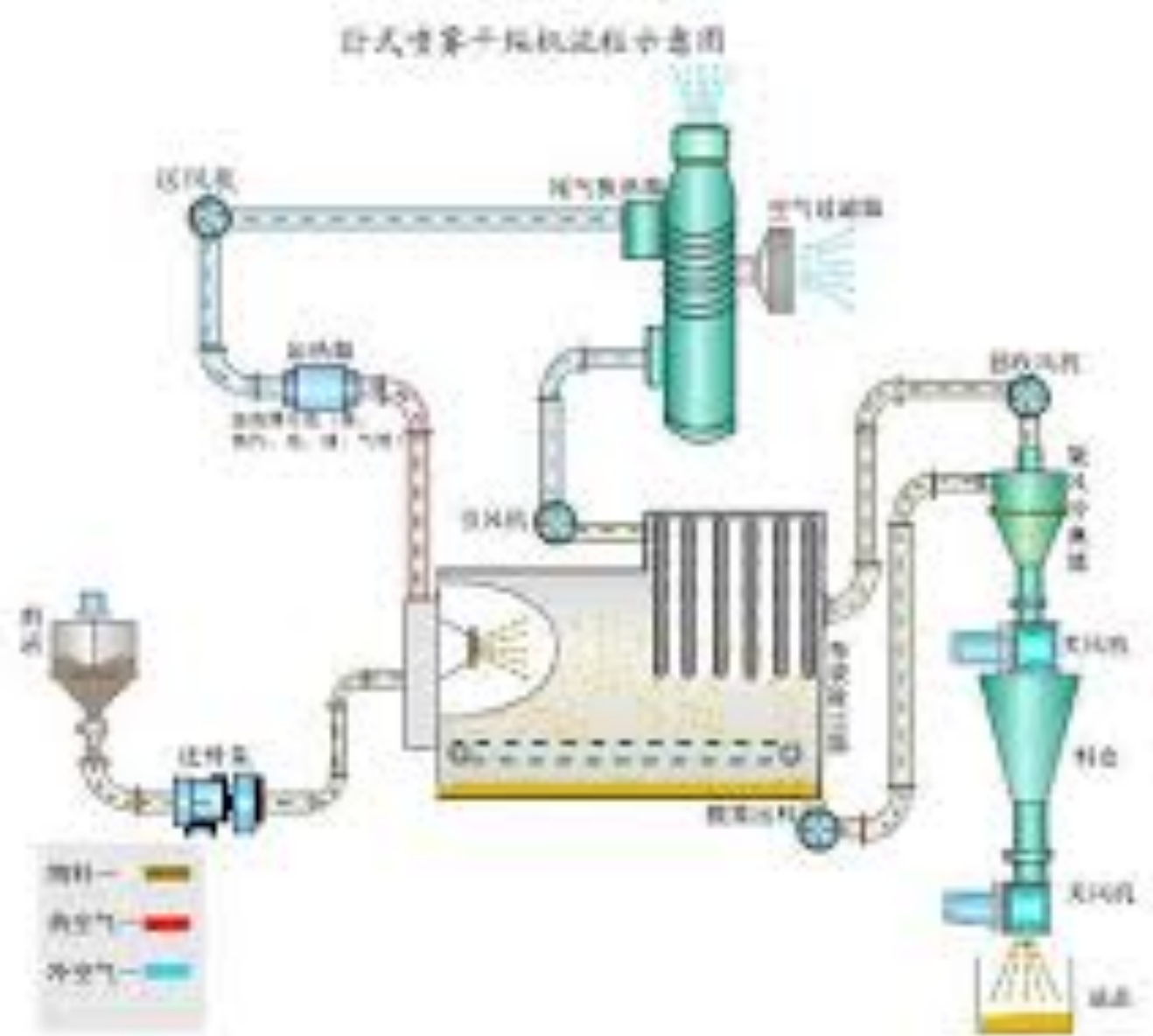




# Position of drying chamber

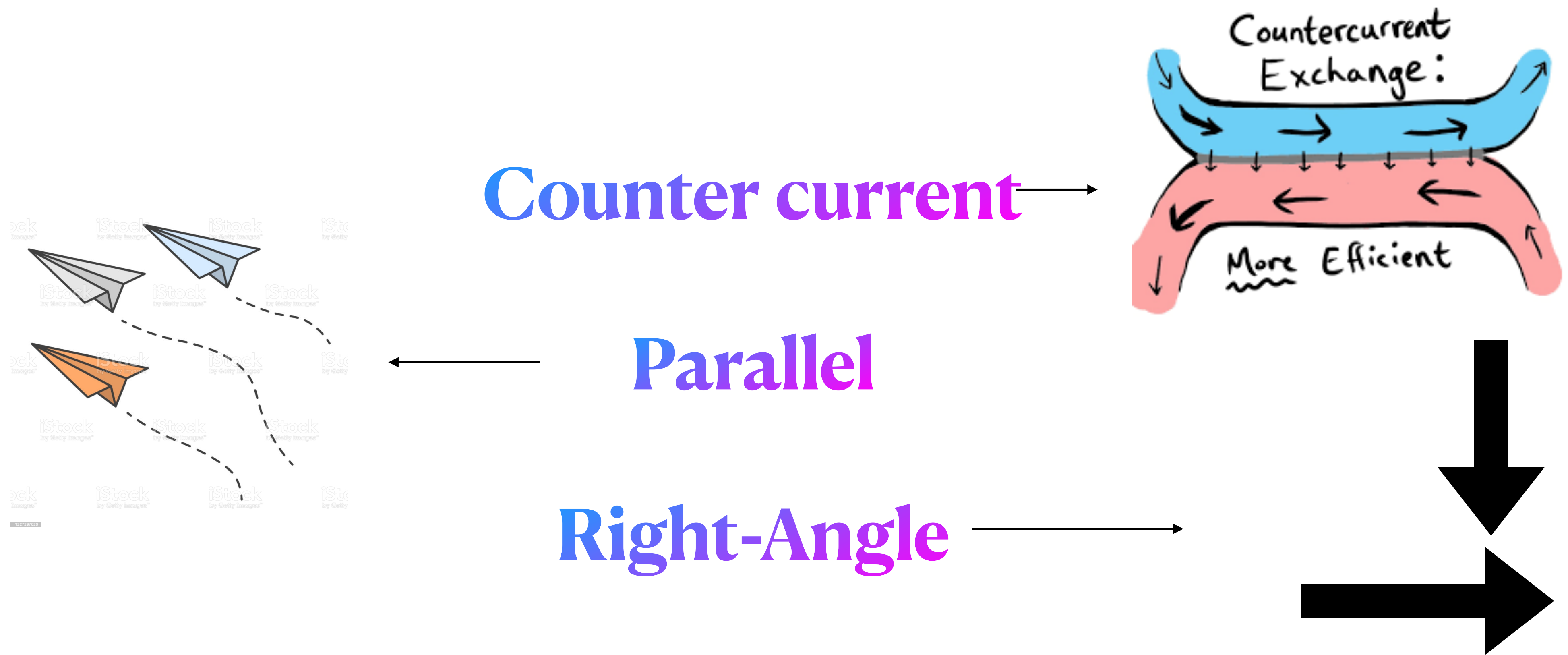
Vertical →

← Horizontal





# Direction of air-flow





# Pressure in drier

**Atmospheric**

**Vacuum**



# Method of separation of powder from air

**Cyclone/ Multi-cyclone**

**Bag Filter**

**Liquid Dust Collector**

**Electric Dust Collector**



# **Treatment & movement of air**

**Recirculation of Air**

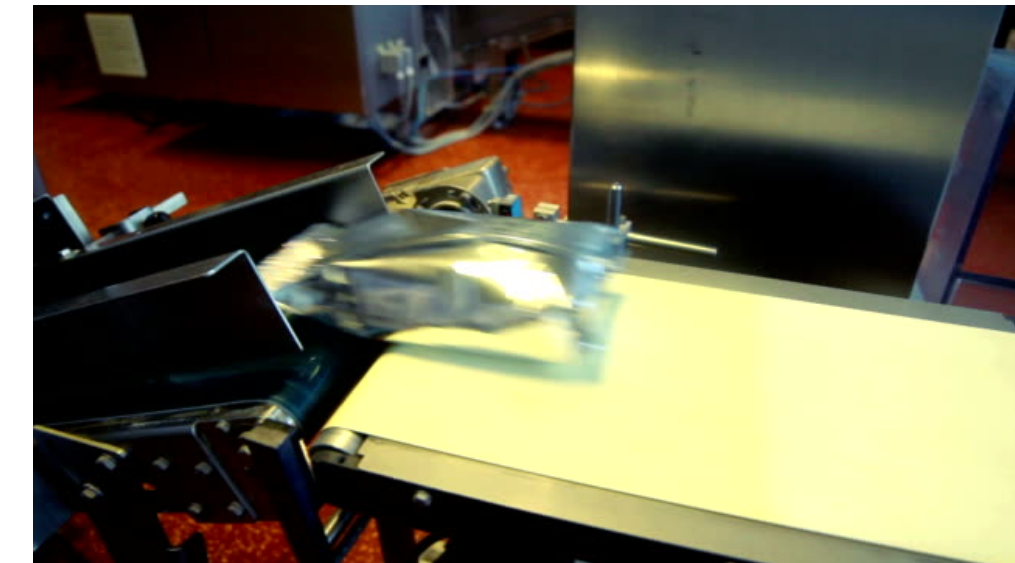
**Dehydration of Air**

**Conventional**



# Removal of powder from drying chamber

Conveyor →



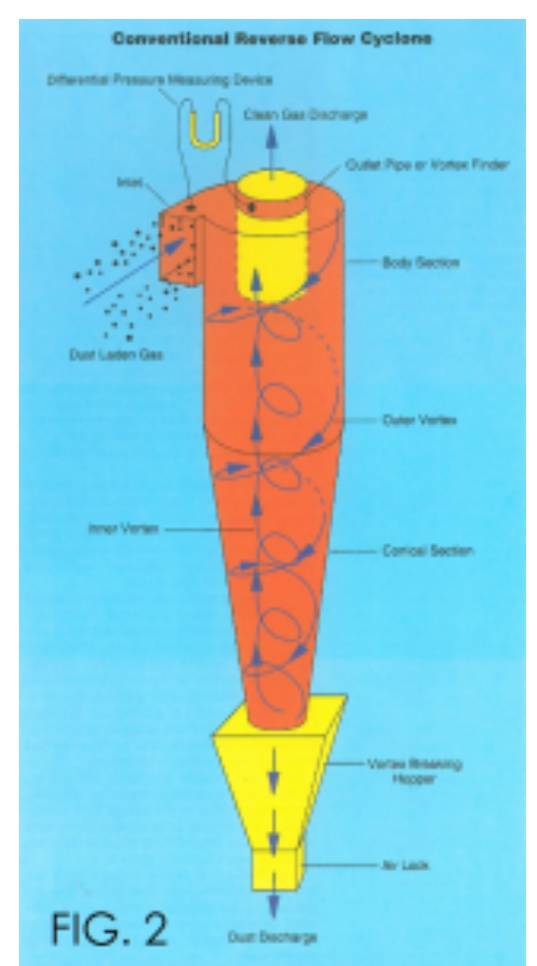
← Vibrator Conveyor



Sweep Conveyor →



← Air conveyed to Cyclone

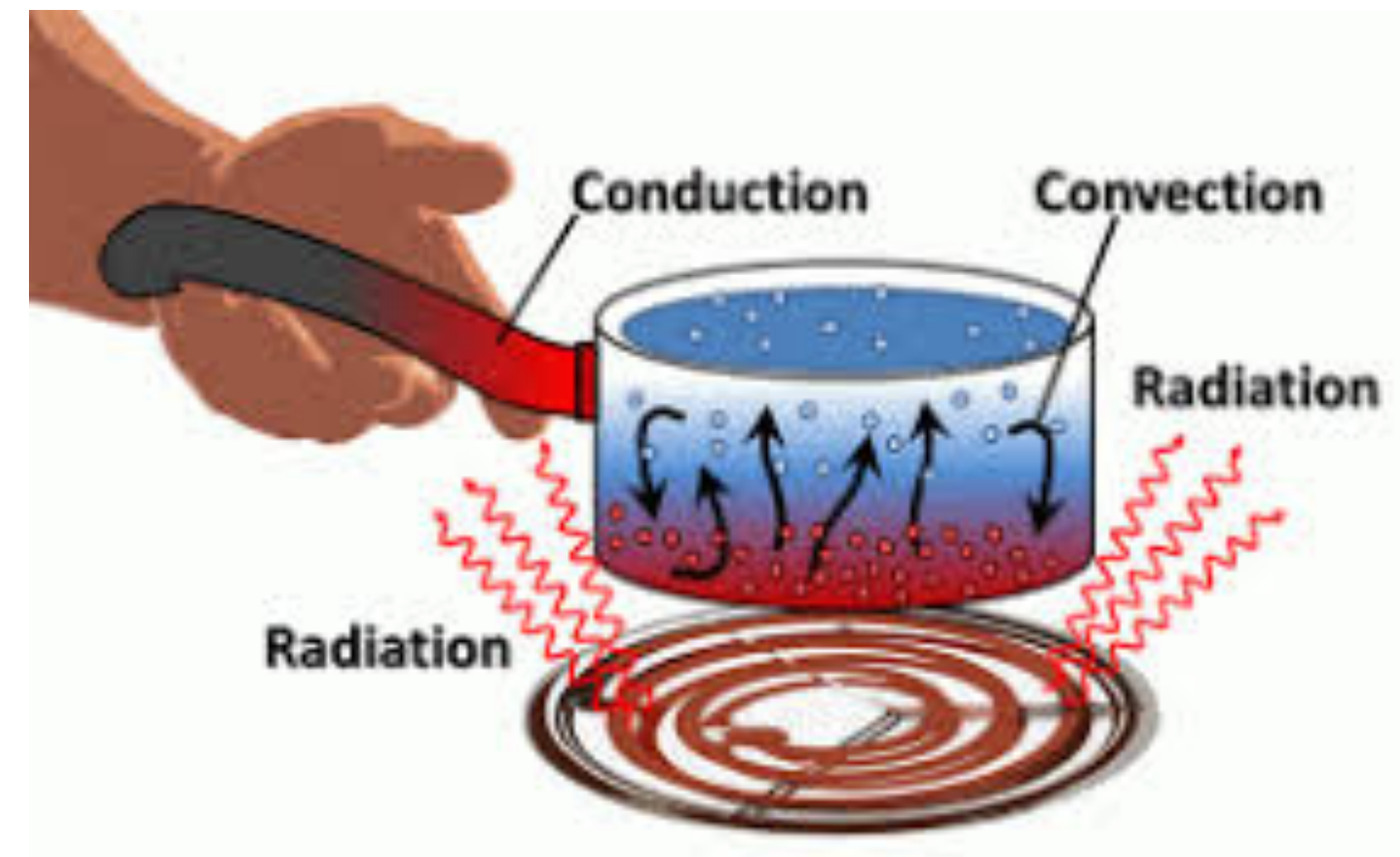




# Method of heat transfer

★ **Convection**

★ **Radiation**





# Drying chamber atmosphere

**Nitrogen**

**Air**

**Others(Usually any inert gas)**



**Position of fan**

**Pressure in chamber**

**Suction in chamber**



# Shape of drying chamber

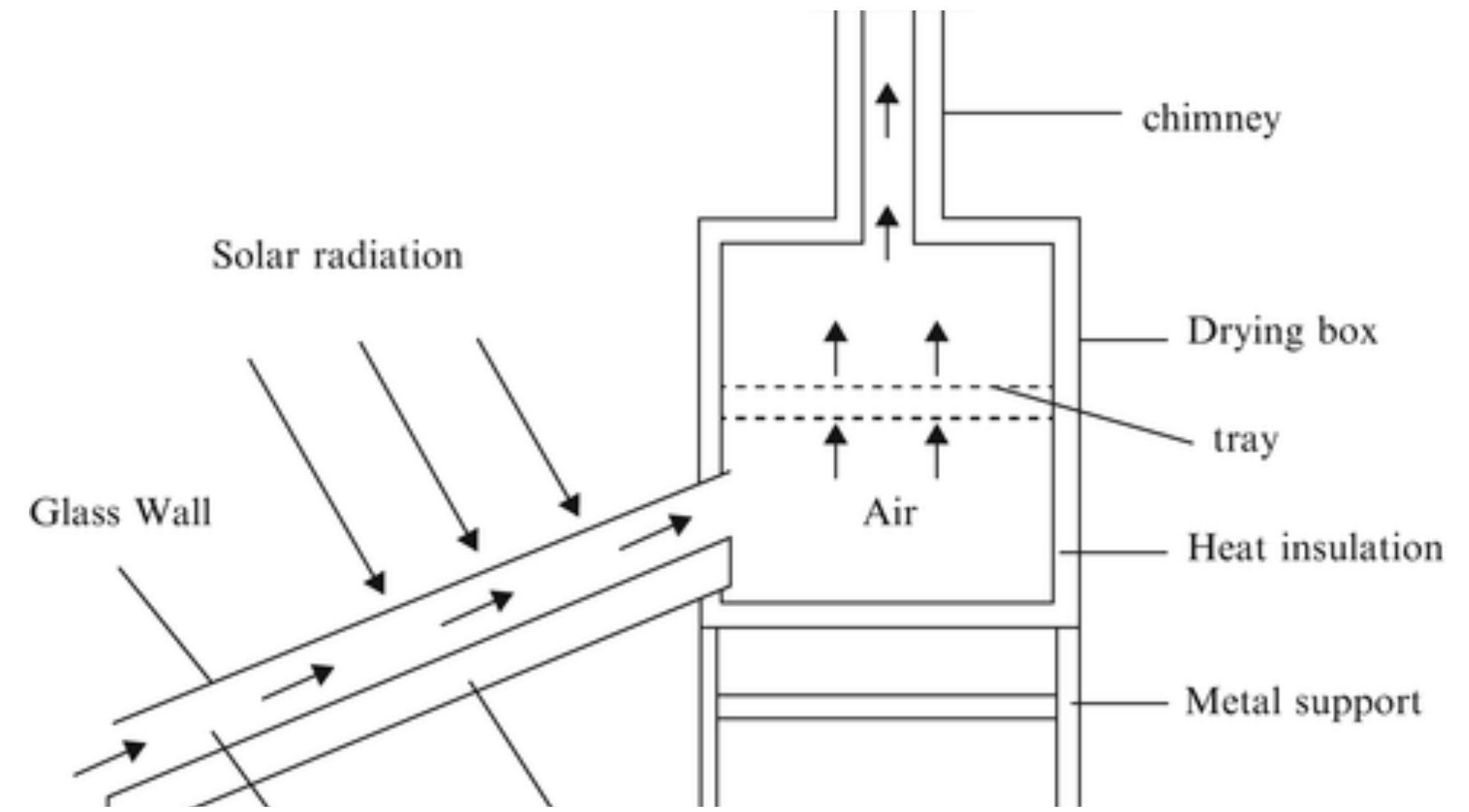
**Silo or Cylindrical**

**Box like**

**Square cross-section**

**Tear-drop**







# Product being dried

**Milk**

**Other milk products**

**Other food products**

# Foam Spray Drying



- ☀ Done by forcing gas into the liquid product after pump but before the atomiser.
- ☀ Air is commonly used as the added gas for making foam spray non-fat dry milk and nitrogen is used as added gas for making foam spray dried whole milk.
- ☀ Used for drying whole milk, skim milk, butter milk, Cream (sweet and sour), whey and emulsified cheese slurry.



*Thank You*

**Dr. Gargi Mahapatra**