PHARMACEUTICAL ENGINEERING

UNIT 3 NOTES

DRYING

- OBJECTIVES
- APPLICATIONS OF DRYING
- DRYING EQUIPMENTS

MIXING

- OBJECTIVES
- APPLICATIONS AND FACTORS
- MECHANISM OF MIXING
- EQUIPMENTS OF MIXING

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DRYING

- Drying can be defined as a process in which the liquid, generally water, present in a wet solid is removed by application of heat and finally a liquid free solid product is obtained.
- Drying is often necessary in various industrial operations to remove moisture from a wet solid.

OBJECTIVES

- To reduce the moisture content in a material to a desired level for improved storage, processing or application.
- To enhance the stability of products by preventing chemical degradation, microbial growth or spoilage caused by moisture.
- To achieve the desired physical properties such as better flowability, reduced stickness & easier handling.
- To make products easier to move, store and use.
- To make products lighter for cheaper storage & transport.
- To maintain the look, feel and effectiveness of the product.

APPLICATION OF DRYING

- **Formulation of Solid Dosage Forms :** Drying is used to remove moisture from granules, powders & wet mass during tablet and capsule manufacturing.
- **Stabilization of Products :** Drying enhances the stability of drugs by reducing moisture, which can cause degradation or microbial growth.
- **Preparation of APIs :** APIs are dried after synthesis to achieve the required purity, stability and physical properties
- **Freeze - Drying :** Used for preserving heat - sensitive drugs, such as vaccines, proteins and biological products. by removing water without affecting their structure.
- **Prolonging Shelf Life :** Dried pharmaceutical products have a longer shelf life as they are less prone to spoilage.

MECHANISM OF DRYING

- Drying involves both Heat Transfer & Mass Transfer process simultaneously.
- Heat transfer takes place from the heating medium to the solid material
- Mass transfer involves transfer of moisture to the surface of the solids & then into the surrounding air.
- The movement of moisture in drying process can be explained by following two theories :

① Diffusion Theory
② Capillary Theory

① Diffusion Theory

- The diffusion theory of drying explains how moisture moves from the inside of a material to the surface during drying process.
- It is based on principle of diffusion.
- According to it, As drying begins, moisture moves from inner layer to the surface because the air around the material has a lower moisture concentration.
- The moisture that reaches the surface then evaporates into the surrounding air.

② Capillary Theory

- According to this theory, inside porous materials (like soil, bricks or paper), water is held in tiny spaces like capillaries.
- These capillaries act like thin tubes, and due to capillary action, water is pulled up or out toward the surface
- Once the water reaches the surface, it evaporates into the air & ~~to~~ more water from inside continues to move toward surface.

EQUILIBRIUM MOISTURE CONTENT

- Equillibrium Moisture Content refers to the moisture level at which a pharmaceutical solid such as powder, granules or tablets neither gain nor loses moisture when exposed to specific environment conditions.
- A this point, the amount of moisture, the material hold is in the balance with the moisture in the surrounding air. Or, we can say, the vapour pressure of water within the solid equals the vapour pressure of water in surrounding atmosphere.

FACTORS AFFECTING EMC

- Temperature : Generally, an increase in temperature leads to decrease in EMC, as warmer air can hold more moisture, reducing material's moisture content.
- Relative Humidity : Lower humidity levels in the surrounding air promote more evaporation & higher humidity levels slow down this process.
- Airflow : Increased airflow can help remove moisture from the material's surface, aiding the drying process.

IMPORTANCE OF EMC

- The EMC is important in determining how much moisture needs to be removed during the drying process.
- Once the material reaches its EMC, it is essentially 'dry' under the given conditions, and further drying would not reduce its moisture content unless condition change.

MEASURMENT OF MOISTURE CONTENT

$$\% \text{ Moisture Content} = \frac{\text{Weight of water in Sample}}{\text{Weight of Dry sample}} \times 100$$

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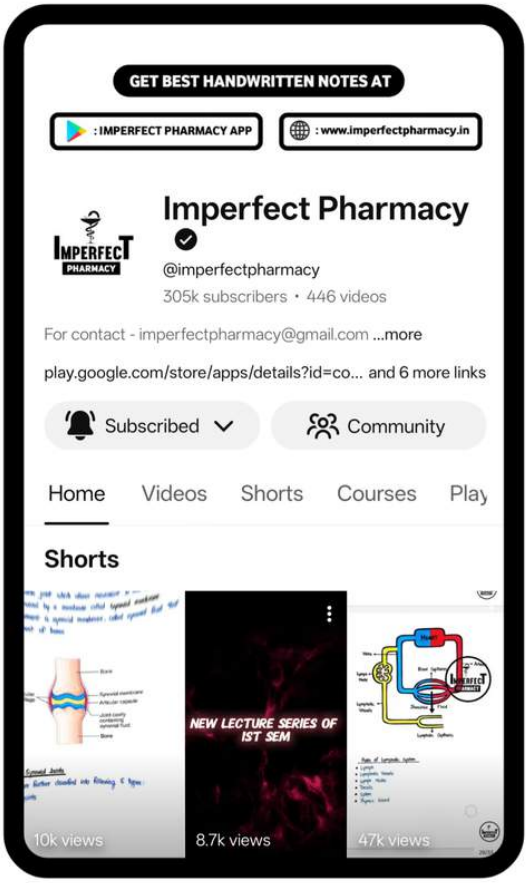

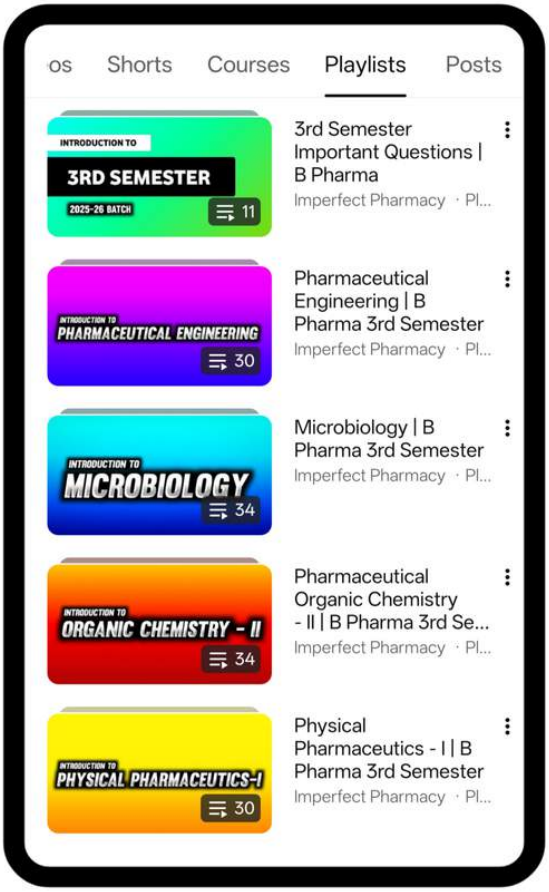

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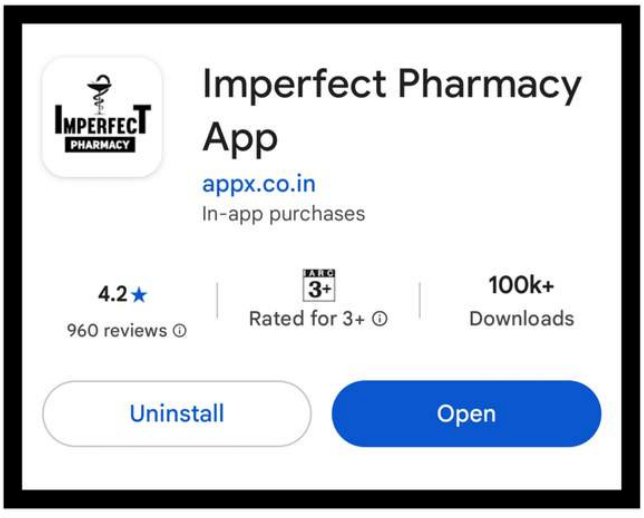
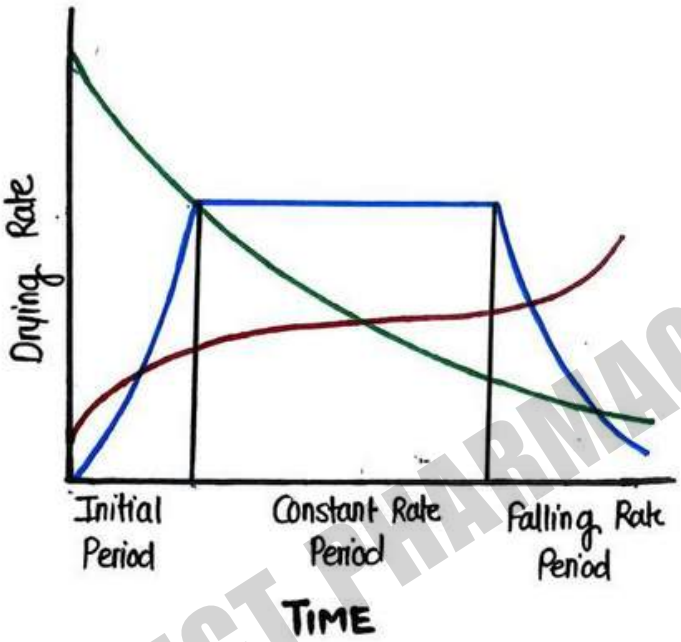


Rate Of Drying Curve & Phases Of Drying

The rate of drying curve describes the relationship between the drying rate of a material and its moisture content during the drying process.



In This Giraph

- Blue Line → Drying Rate vs Time
- Green Line → Percent of Moisture Content vs Time
- Red Line → Product Temperature vs Time

① Initar Period / Phase

- In initial period, rate of drying increases with time.
- Surface water and interstitial water gets evaporated in Initial Period.
- Percent of moisture content decreases exponentially.
- Temperature of product increases.

② Constant - Rate Period

- In constant rate period, the rate of drying remain constant with time.
- Percent of moisture content decreases exponentially.
- Temperature of product increases.

③ Falling Rate Period

- In falling rate period, the rate of drying decreases with time.
- Percent of moisture content still decreases.
- Temperature is still increases.

CONCLUSION

- At the end, rate of drying is least.
- Percent of moisture content is minimum
- Temperature of product is maximum

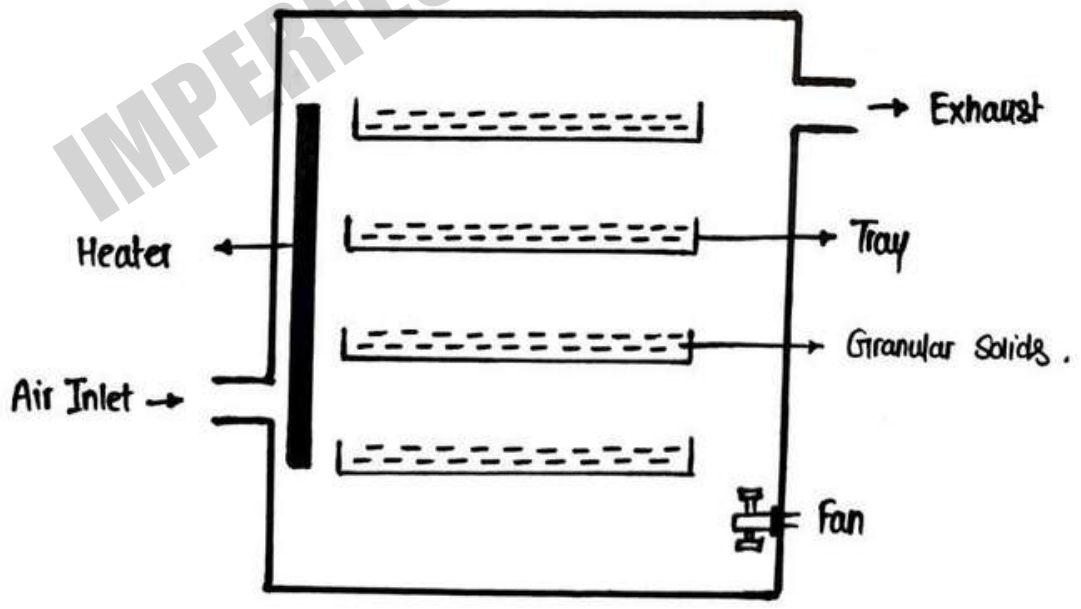
① TRAY DRYER

PRINCIPLE

- Tray dryer operates on the principle of convection drying.
- Heated air is circulated over trays containing the wet material
- The moisture in the material evaporates and is carried away by air steam

CONSTRUCTION

- Chamber : A Closed chamber made of metal or other suitable material.
- Trays : Perforated trays, made of metal or plastic, placed inside chamber.
- Heating System : Heaters to heat the air
- Air Circulation System : Fans to circulate the heated air over the trays.
- Exhaust : To remove moist air from chamber.



WORKING

- The wet material is spread evenly on the trays.
- The heater raise the temperature inside the chamber
- Fans circulate the hot air over the material, removing moisture.
- Moist air is removed from the chamber
- The process continues until material reaches the desired moisture content.

ADVANTAGES

- Simple Design
- Versatility
- Uniform Drying

DISADVANTAGES

- Time Consuming
- Manual Handling
- Limited Capacity

APPLICATION

- Drying powders, granules & tablets.
- Drying fruits, vegetable.
- Drying chemicals, resins etc.

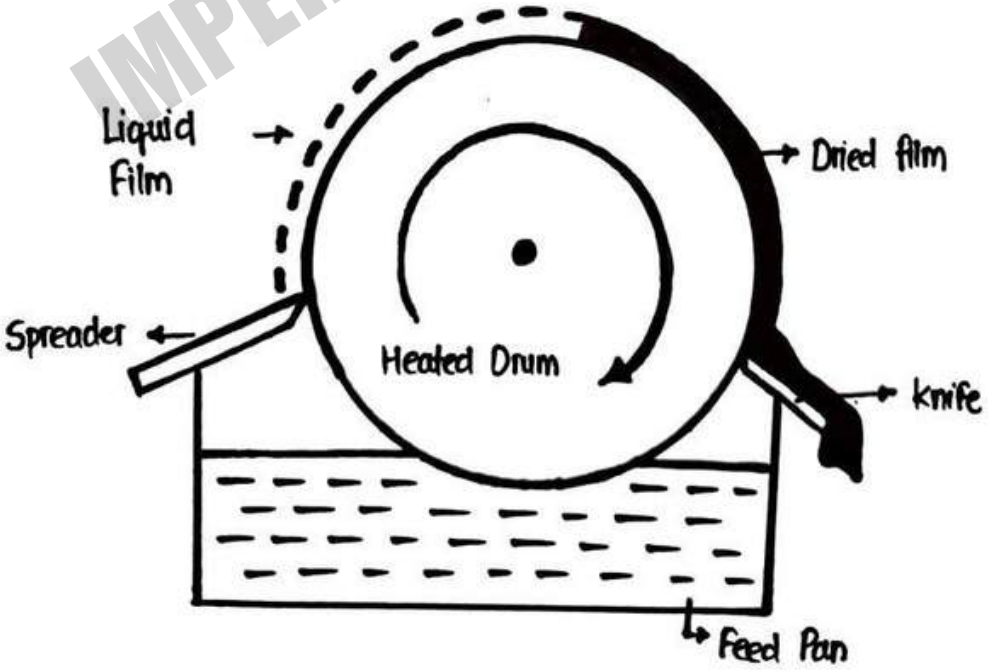
② DRUM DRYER

PRINCIPLE

- A drum dryer operates on the principle of Heat Conduction.
- The liquid or slurry to be dried is applied as a thin film onto the surface of rotating heated drum.
- Heat is transferred from drum to the material, causing the moisture to evaporate
- The dried material is then scraped off.

CONSTRUCTION

- Drum: A hollow, cylindrical drum made of metal
- Heating System: Steam or hot water is used to heat the drum.
- Feeding System: Contains the wet material to be dried.
- Scraper: A knife like blade that removes dried material from drum.
- Spreader: To spread the material evenly onto the drum surface.



WORKING

- The wet material is applied to rotating drum's outer surface.
- The drum is internally heated with steam or hot air. which raises the temperature of drum's surface.
- As the drum rotates, applied material gets dried due to heat transfer.
- The dried material is then scraped off using scraper blade.
- The evaporated moisture is removed by exhaust system.

ADVANTAGES

- Uniform Drying
- Fast Drying
- Simple Operation

DISADVANTAGES

- High Initial Cost
- Low Flexibility

APPLICATION

- Food Industry
- Pharmaceuticals
- Chemical Industry.

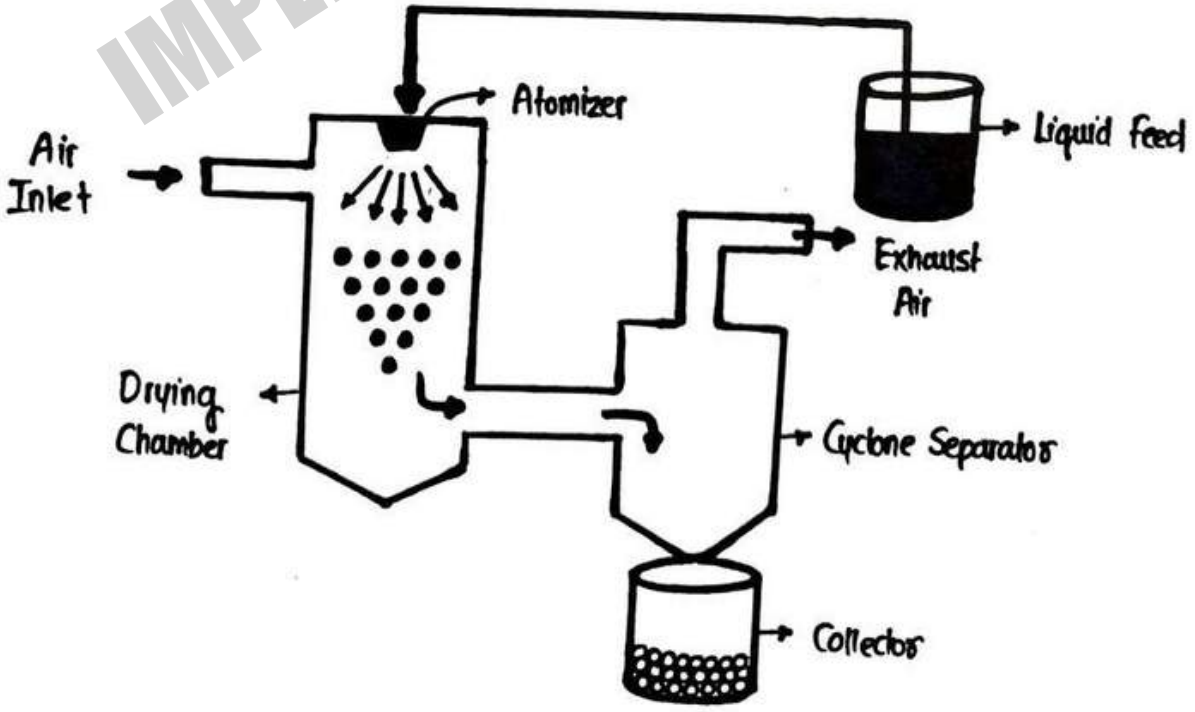
③ SPRAY DRYER

PRINCIPLE

- The principle of spray dryer is based on Atomization & rapid evaporation. The liquid feed is atomized into fine droplets. which is expressed to a hot drying medium (usually air)
- The large surface area of the droplets enables rapid moisture evaporation, leaving behind dry particles.

CONSTRUCTION

- Feed System : A pump that delivers the liquid or slurry to the atomizer.
- Atomizer : Converts the liquid into fine droplets
- Drying Chamber : A cylindrical / conical chamber, where droplets are exposed to hot air
- Hot Air Inlet : Supplies Hot Air to the system
- Cyclone Separator : Separate dried particles from exhaust air
- Collector : Collects dry product.



WORKING

- The liquid feed is pumped into the atomizer, where it is broken into fine droplets.
- Hot air is introduced into the drying chamber.
- The fine droplets come into contact with the hot air, causing rapid evaporation of moisture.
- The dried particles are separated from the air in the cyclone separator & collected in the containers.
- The moist air is removed through the exhaust system.

ADVANTAGES

- Fast Drying
- Suitable for Heat-sensitive material
- Continuous Operation

DISADVANTAGES

- High Initial Cost
- Energy Consumption

APPLICATION

- Food Industry
- Pharmaceutical Industry
- Chemical Industry

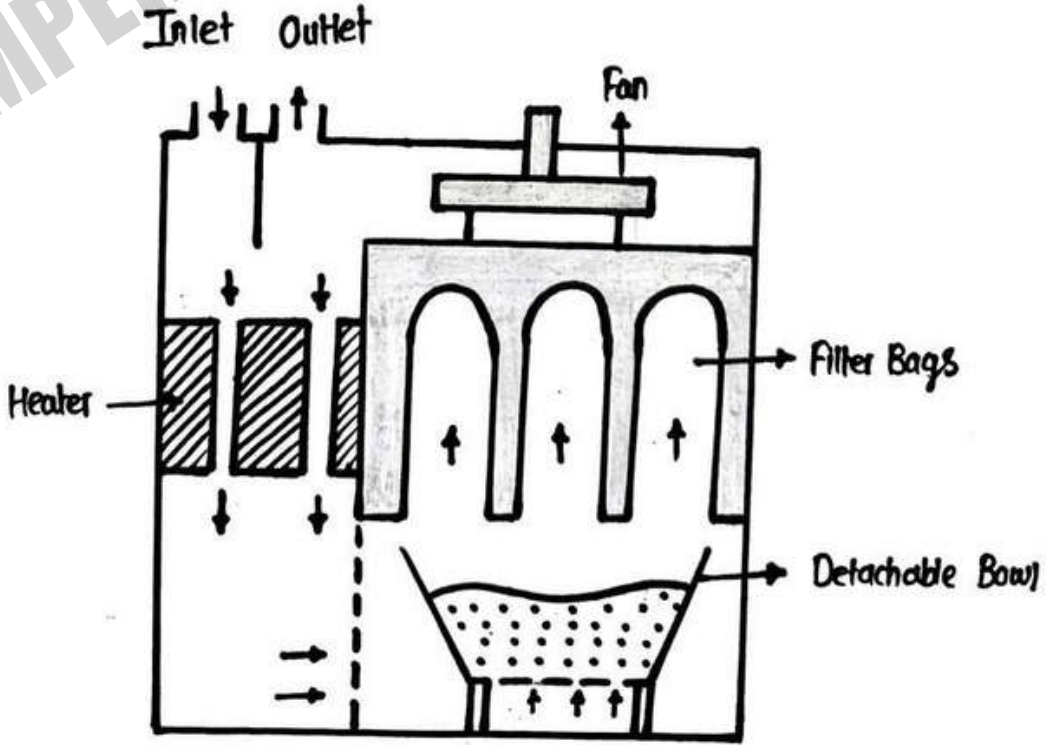
④ FLUIDIZED BED DRYER

PRINCIPLE

Fluidized bed dryer operates on the principle of fluidization, where a bed of solid particles is transformed into a fluid-like state by passing a stream of hot air through it.

CONSTRUCTION

- Chamber: A Closed chamber typically made of stainless steel
- Perforated Plate: A Perforated Plate at the bottom of the chamber allows passage of hot air.
- Fan: A fan to distribute hot air evenly across plate.
- Heating System: A Heater to heat the air
- Air Inlet: Inlet through through which air enters.
- Filter Bags: Prevent solid particles from escaping.



WORKING

- The wet material is fed into the chamber.
- Heated air is passed through the perforated base plate at high velocity.
- The material particles are lifted and suspended in the air stream, behaving like a fluid.
- The hot air transfers heat to the particles, causing moisture to evaporate
- The moist air is removed through the exhaus system.
- The dried material is discharged after drying process is complete.

ADVANTAGES

- Efficient Drying
- Uniform Drying
- Versatile

DISADVANTAGES

- High Initial Cost
- Not suitable for sticky material

APPLICATION

- Pharmaceutical Industry
- Food Industry
- Chemical Industry

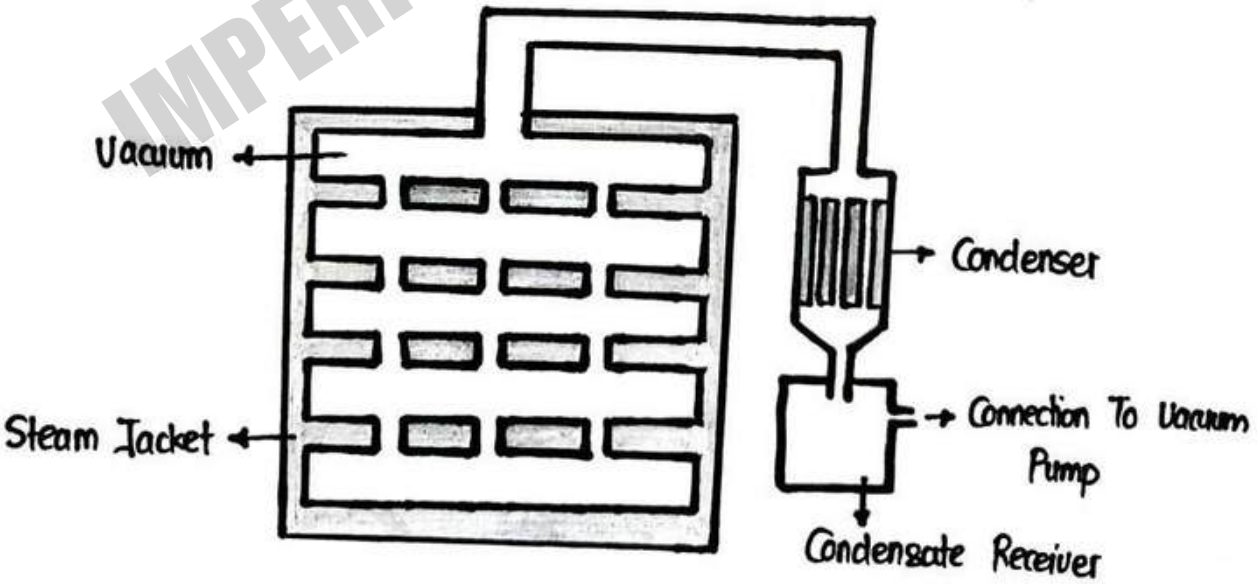
⑤ VACUUM DRYER

PRINCIPLE

- The principle of a vacuum dryer is based on vacuum drying. Under reduced pressure, the boiling point of moisture or
- solvent decreases, enabling evaporation at lower temperatures.
- This minimizes thermal degradation of heat-sensitive materials while effectively drying them.

CONSTRUCTION

- Drying Chamber : A Sealed rectangular chamber where material is placed.
- Shelves / Trays : Hold the material to be dried
- Heating System : Supplies heat to material
- Vacuum Pump : Creates & maintains vacuum
- Condenser : Cools & condenses the evaporated moisture.



WORKING

- The wet material is placed on trays or shelves inside the vacuum chamber.
- The chamber is sealed to create an airtight environment.
- The vacuum pump reduces the pressure inside the chamber.
- Heat is applied to the material via conduction or radiation, causing the moisture to evaporate.
- The moisture evaporates at lower temperature due to vacuum, minimizing thermal damage.
- The evaporated moisture is condensed and collected by condenser.
- The dried material is removed, once the desired moisture level is achieved.

ADVANTAGES

- Low- Temperature Drying
- Energy Efficient

DISADVANTAGES

- High Initial Cost
- Slow Process

APPLICATION

- Pharmaceutical Industry
- Food Industry
- Chemical Industry.

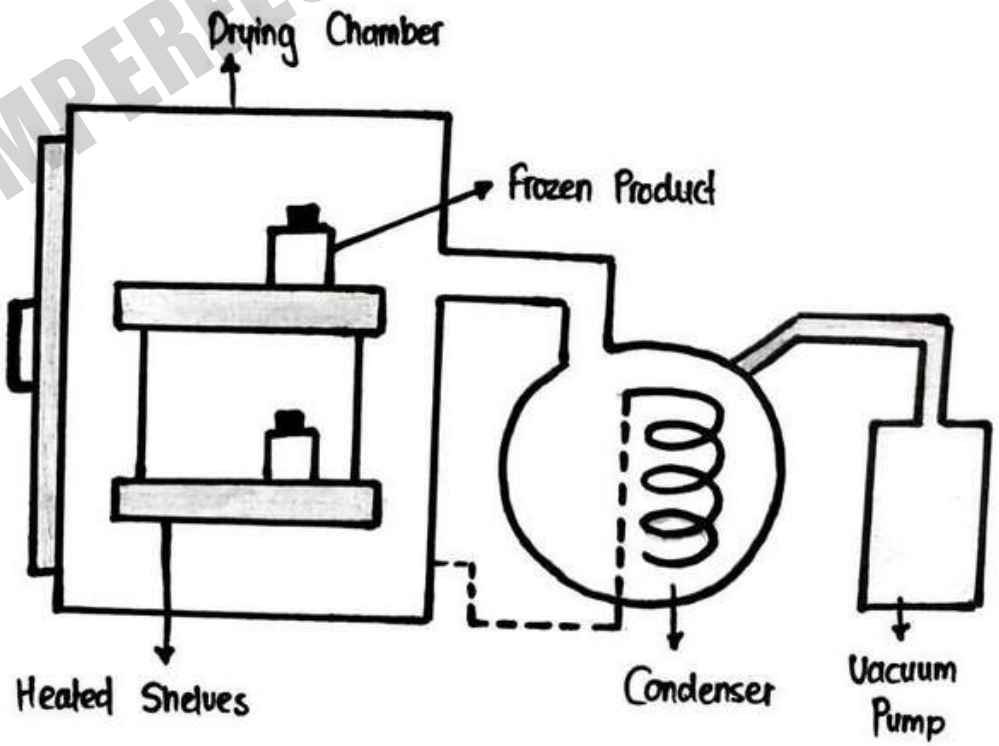
⑥ FREEZE DRYER

PRINCIPLE

A freeze dryer is a type of equipment used to remove water or solvents from a product by freezing it and then sublimating the ice directly into vapour, bypassing the liquid phase.

CONSTRUCTION

- Drying Chamber: A chamber where the material is placed for drying.
- Shelves | Trays: Used to hold the frozen material inside the chamber
- Vacuum System: A vacuum pump to reduce the pressure and create the condition for sublimation
- Heating System: Provides controlled heat to drive the sublimation process.
- Condenser: Captures and condenses the vapourized water



WORKING

- The material is first frozen to a temperature below its freezing point.
- Now it is placed in the drying chamber and a vacuum is applied to reduce the pressure
- Now Heat is gently provided to the frozen material, causing the ice to sublimate directly into water vapour
- The water vapour is then condensed in the condenser
- The process continues until all the moisture is removed.

ADVANTAGES

- Retention of Quality
- Long Shelf life
- Ideal for Heat-sensitive materials

DISADVANTAGES

- High Initial Cost
- Energy Intensive

APPLICATION

- Food Industry
- Pharmaceutical Industry
- Biotechnology

MIXING

- Mixing refers to process of combining different ingredients, such as API, excipients and other components to create a uniform formulation.
- This could involve mixing powders, liquids or semi-solids to ensure that final product has consistent properties, such as uniformity in dosage, texture and stability.

OBJECTIVES OF MIXING

- It ensures even distribution of all the ingredients throughout the mixture.
- It helps enhancing bioavailibility of drugs.
- It ensures the mixture is uniform in composition, without any separation.
- It guarantees that each dose contains the correct amount of active pharmaceutical ingredient.
- It enhances physical properties like appearance, flow & feel of the product.
- It prevents separation.

APPLICATION OF MIXING

- Mixing ensures the medicines and other ingredients spread evenly so that every capsule & every tablet has right amount of API
- It helps dissolve API in solvent to prepare liquid formulations.
- It ensures smoothness of product.
- For products like suspensions & emulsions, it prevents ingredients from separating over time.
- Uniform mixing ensures each dose of medicines works the same way.

FACTORS AFFECTING MIXING

There are various factors that can affect mixing as follows:

① Particle Size

- Smaller particles mix more easily than larger ones, as they have greater surface area for interaction, leading to better uniformity.

② Density of Materials

- Differences in density between components can cause separation during mixing.
- Lighter materials may float on top, while heavier materials sink.

③ Viscosity

- For liquid or semi-solid mixtures, the viscosity affects how well the ingredients mix.
- Higher viscosity can make mixing more difficult.

④ Shape of Particles

- Irregularly shaped particles may not mix as efficiently as spherical ones, as they can lead to poor flow and uneven distribution.

⑤ Speed of Mixing

- The speed or intensity of mixing can influence how thoroughly ingredients are blended.
- Too fast or too slow can result in poor mixing.

⑥ Type Of Mixer

- The design and type of mixing equipment used can significantly impact the efficiency and uniformity of mixing.

⑦ Temperature

- Temperature can affect flow properties of materials.
- For example, higher temperature may reduce viscosity and improve mixing, but excessive heat can also degrade certain ingredients.

⑧ Moisture Content

- The amount of moisture in materials can affect their ability to mix, especially in powders or granules, potentially leading to clumping or uneven blending.

TYPES OF MIXING

There are mainly 3 types of Mixing

① Solid Mixing
② Liquid Mixing
③ Semi solid Mixing

① SOLID MIXING

Solid Mixing refers to the process of combining two or more solid materials to achieve a uniform distribution of their components.

MECHANISM

There are mainly 3 mechanisms of solid mixing.

ⓐ Convective Mixing
ⓑ Shear Mixing
ⓒ Diffusive Mixing

ⓐ Convective Mixing

- In this process, a large mass of material moves from one part to another due to movement of mixer or equipment.
- As the material moves, particles are carried along with the bulk flow, contributing to mixing.

ⓑ Shear Mixing

- It is a process where materials are mixed using shear forces.
- Shear forces acts on the particles, causing them to slide over one another.
- This motion helps break up clusters of particles and spread them more evenly.

© Diffusive Mixing

- When solid particles are mixed, they undergo random displacement due to differences in size.
- Smaller particles or fine powders can diffuse more easily through bulk, helping achieve uniform distribution over time.

② Liquid Mixing

Liquid Mixing refers to the process of combining two or more liquids to create a uniform mixture.

Mechanism Of Liquid Mixing

① Turbulent Mixing

Turbulent Mixing is the rapid and ~~chotic~~ ~~blending~~ chaotic blending of liquids caused by high speed flow, creating swirling motions that mix liquids efficiently.

② Laminar Mixing

Laminar Mixing in liquid mixing is the slow and smooth blending of liquids where layers of liquid slide over each other without much disruption, resulting in a gradual mix.

③ Bulk Transport

Bulk Transport is the movement of large volumes of liquid within the mixing container, driven by stirring or flow, to help distribute ingredients evenly

③ SEMI SOLID MIXING

- Semi - solid mixing is the process of blending thick, viscous materials, like creams, gels or pastes to achieve a uniform consistency and distribution of ingredients.
- Mechanisms for Semi - solid mixing involves shear mixing, convective mixing and diffusive mixing.

DIFFERENCE BETWEEN SOLID & LIQUID MIXING

SOLID MIXING	LIQUID MIXING
• Product is usually a true homogenous liquid phase	• Two or more phases can be identified
• Requires less power	• Riquires high power
• Mechanism involves turbulent mixing, laminar mixing and bulk transport	• Mechanism involves convective mixing shear mixing, diffusive mixing etc.
• Liquid Mixing is generally simple	• Solid Mixing is more complex.

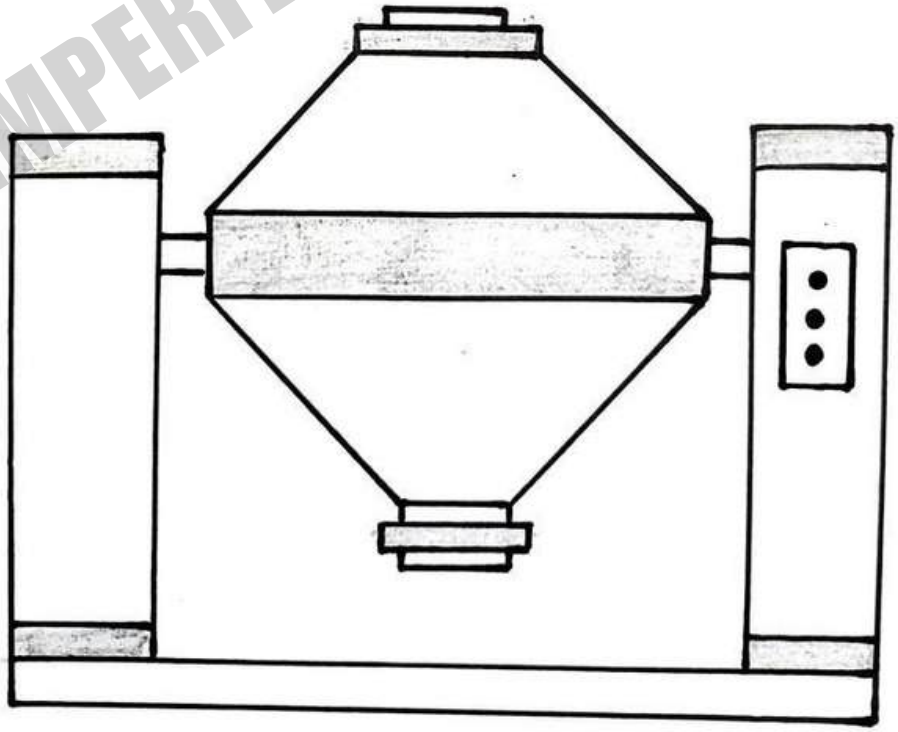
① DOUBLE CONE BLENDER

PRINCIPLE

The principle of double cone blender is based on tumbling motion of powder or granules inside double cone shaped vessel.

CONSTRUCTION

- Blender Body : A double - cone shaped chamber made of stainless steel or other non- corrosive material.
- Inlet : Inlet for material entry and loading.
- Outlet : An outlet to discharge material after blending.
- Support Frame : Support and rotates the blender body.
- Control Panel : To control and adjust blender speed.



WORKING

- Dry powders or granules are loaded into the blender through the loading port.
- The blender rotates around its axis at a specific speed, creating a tumbling motion.
- Materials move in multiple directions due to the conical shape, promoting uniform mixing.
- After blending, blended material is discharged from outlet port.

ADVANTAGES

- Uniform Mixing
- Low Energy Consumption
- Versatile

DISADVANTAGES

- Not suitable for materials with high moisture content
- Time Taking

APPLICATION

- Mixing of Powders
- Capsule Filling
- Food Industry

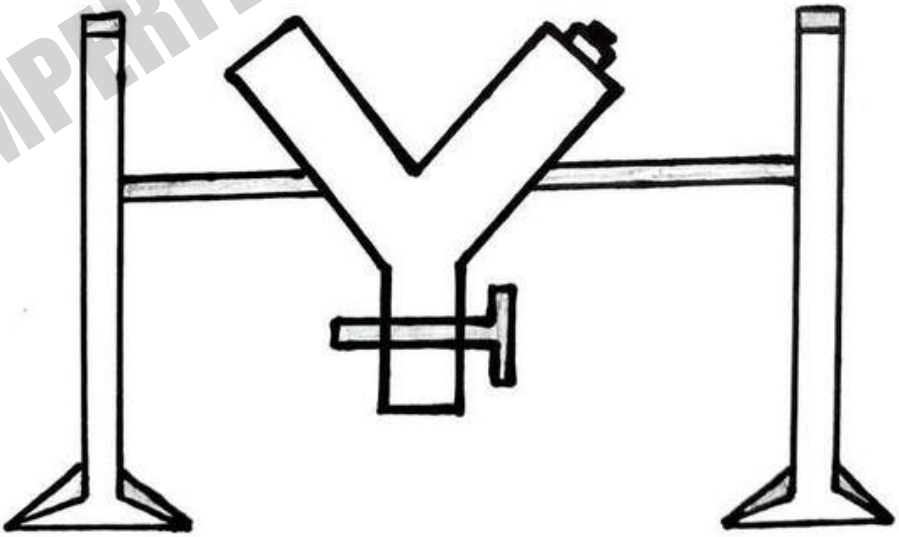
② TWIN SHELL BLENDER

PRINCIPLE

The twin shell blender works on the principle of tumbling motion. The movement of blender increases the mobility of each particle. thus promoting uniform mixing.

CONSTRUCTION

- V- Shaped Chamber : Two cylindrical sections joined at an angle to form V- shape, typically made of steel for durability.
- Rotating Shaft : Connects blender body to motor for smooth rotation.
- Inlet : An opening at the top for feeding material
- Outlet : An outlet for unloading of blended material



WORKING

- The dry powders or granules are loaded into the V-shaped chamber through the loading port.
- The chamber rotates around its axis, causing the materials to tumble and mix.
- The V-shape creates a continuous dividing and recombining motion, ensuring a uniform blend.
- After blending, material is discharged from outlet port.

ADVANTAGES

- Uniform Mixing
- Low Energy consumption
- Scalable

DISADVANTAGES

- Not suitable for liquids
- Time Taking

APPLICATION

- Mixing excipients, powders etc.
- Blending spices, flour
- Mixing fertilizers, pigments.

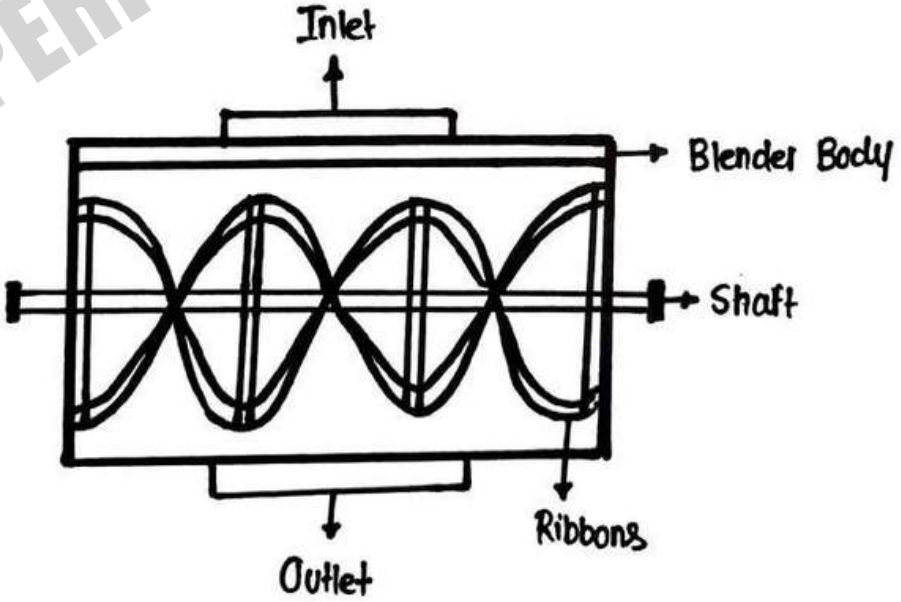
③ RIBBON BLENDER

PRINCIPLE

Ribbon Blender operates on the principle of convective mixing, where materials are moved and redistributed within the mixing chamber.

CONSTRUCTION

- Blender Body : A Housing that surrounds ribbon blades.
- Shaft : To rotate the bladdes and provide attachment.
- Motor : Provides power to rotate the shaft.
- Inlet : Through which feed introduced.
- Outlet : Through which material discharged.
- Ribbons : Inner and outer ribbon shaped bladdes.



WORKING

- The material to be mixed loaded in the chamber.
- The motor drives the shaft, causing ribbons to rotate.
- Outer ribbon move materials from ends to the centre.
- Inner ribbon move materials from centre to ends.
- After desired mixing time, material is discharged through discharge valve.

ADVANTAGES

- Uniform Mixing
- Versatile
- Scalable

DISADVANTAGES

- Time Consuming
- Overheating

APPLICATION

- Blending excipients, powders
- Mixing spices, flour
- Mixing fertilizers, detergents

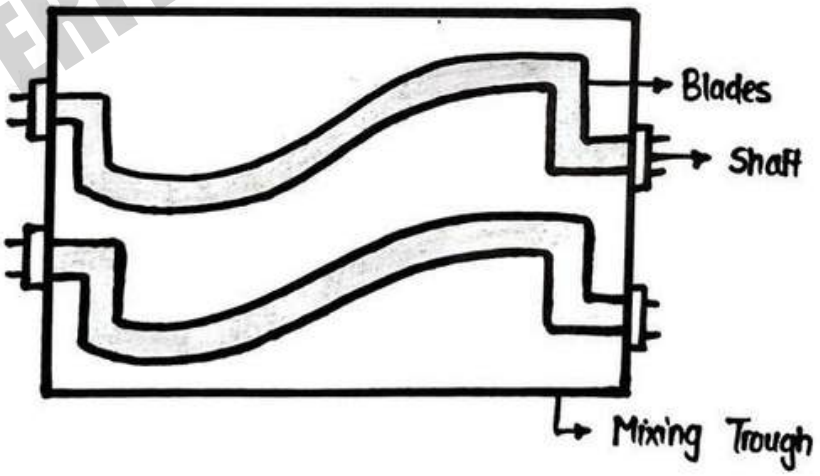
④ SIGMA BLADE MIXER

PRINCIPLE

- The sigma blade mixer works on the principle of shear and convective mixing.
- It mix materials by using two sigma- shaped blades that rotates in opposite directions.

CONSTRUCTION

- Mixing Trough : A housing body that encloses sigma blades made of stainless steel.
- Sigma Blades : Two horizontally mounted, sigma shaped blades rotates in opposite directions.
- Shaft : Helps to rotate sigma blades.



WORKING

- Materials are introduced into the mixing trough, typically filling it about 40-65% of its total capacity to allow adequate space for movement.
- The blades rotate in opposite directions, creating a shearing and kneading action.
- This action breaks down lumps, disperses ingredients and ensures a homogenous mixture.

ADVANTAGES

- Efficient Mixing
- Versatility
- Gentle Mixing

DISADVANTAGES

- High Energy Consumption
- High Initial Cost

APPLICATION

- Food Industry
- Pharmaceutical Industry

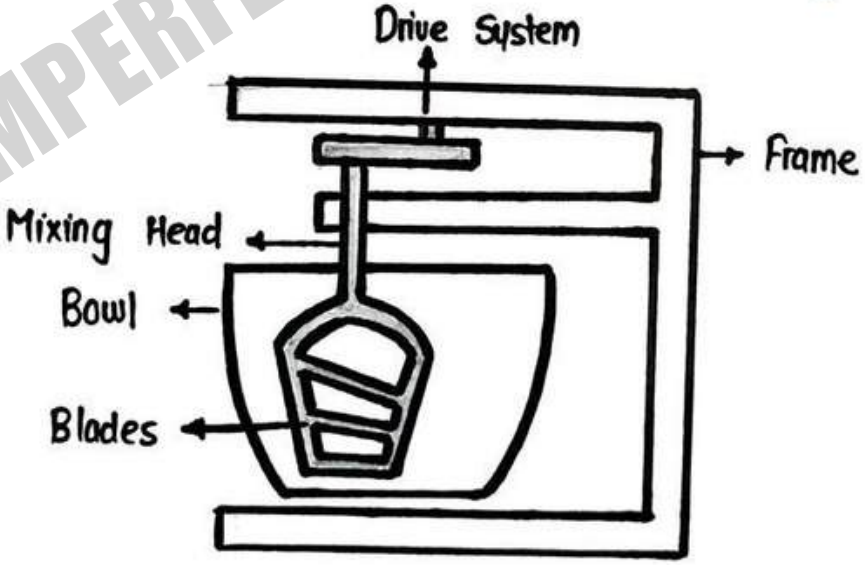
⑤ PLANETARY MIXER

PRINCIPLE

The Planetary mixer works on the principle of Planetary Motion. The mixing head equipped with blades, rotates on its own axis while simultaneously orbiting around the centre of mixing bowl.

CONSTRUCTION

- Mixing Bowl : A stationary, cylindrical bowl that holds the material to be mixed, generally made of stainless steel.
- Mixing Head : A central mixing head that rotates on its own axis.
- Blades : Various types of blades can be attached to the mixing head.
- Drive System : A motor and gearbox to power the mixing head's rotation and orbit
- Frame : A sturdy frame to support bowl and mixing head.



WORKING

- The ingredients are first placed in bowl.
- The mixing head rotates on its own axis while simultaneously orbiting around the center of the bowl.
- This creates a powerful mixing action that incorporates all ingredients thoroughly.
- Once the mixing is complete, the mixed material can be removed from the bowl.

ADVANTAGES

- Efficient Mixing
- Versatility
- Easy to use

DISADVANTAGES

- Limited Capacity
- Cleaning Challenges

APPLICATION

- Mixing Ointments, creams
- Mixing spices, cakes
- Mixing Paints, Adhesives.

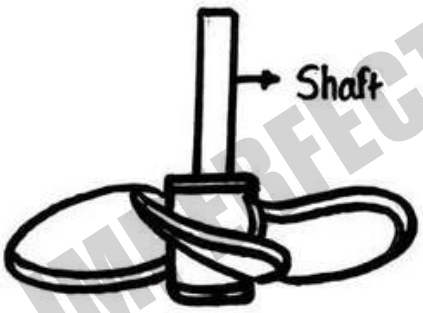
⑥ PROPELLER

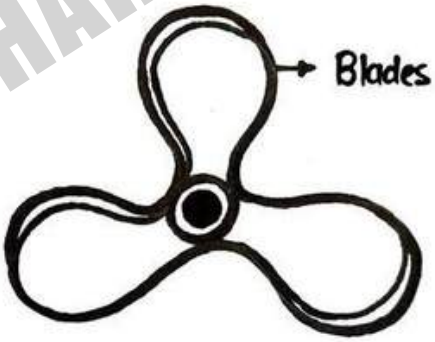
PRINCIPLE

Propeller works on the principle of Shearing force.

CONSTRUCTION

- Propeller Blade : A small, multi blade component usually made of stainless steel.
- Shaft : Connects the propeller to motor
- Motor : Powers the rotation of the propeller.
- Tank : Holds the material to be mixed.





WORKING

- The motor drives the propeller blade, causing it to rotate
- The rotation creates an axial flow, circulating the liquid throughout the tank.
- This movement ensures uniform mixing by blending the components efficiently

ADVANTAGES

- Efficient for Liquids
- Simple Design
- Cost Effective

DISADVANTAGES

- Not suitable for thick materials
- Not suitable for Emulsification

APPLICATION

- Mixing solvents, acids.
- Mixing chemical solutions
- Blending Beverages, sauces

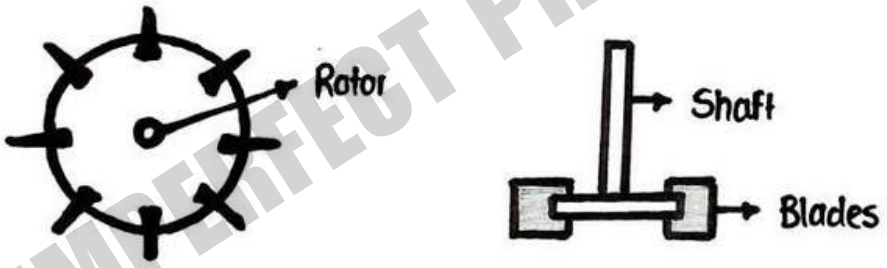
⑦ TURBINES

PRINCIPLE

- Turbine mixers operates on the principle of sheau force generation.
- As the turbine blade rotates, they create a combination of rotational & centrifugal movements, producing turbulent flow in liquid.

CONSTRUCTION

- Rotor: The central rotating part of turbine, consist of shaft with blades.
- Blades: Multiple flat or curved blades attached to central hub.
- Shaft: Connects the blades assembly to a motor.
- Motor: Provides necessary power to rotate the blades.



WORKING

- The motor activates, causing the shaft and attached blade to rotate.
- The rotating blades impart kinetic energy to the liquid, generating turbulent flow patterns.
- The turbulence and blade movement helps to mix the liquid components uniformly.
- The process continues until desired homogenous mixture is achieved in the mixture.

ADVANTAGES

- Effective Mixing
- Versatility
- Suitable for Viscous liquids.

DISADVANTAGES

- Energy Consumption
- Maintainance Needs

APPLICATION

- Liquid Mixing
- Suspension Preparation
- Emulsification

⑧ PADDLES

PRINCIPLE

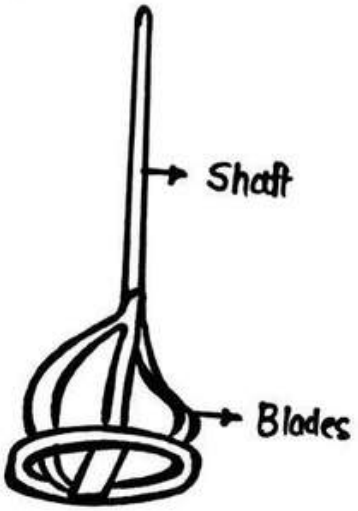
Paddles works on the principle of generating a laminar flow and application of shearing forces.

CONSTRUCTION

- Blades: Long, flat blades attached vertically to central hub
- Shaft: Provides attachment to blades.
- Motor: Drives the rotation of the shaft.
- Tank: A container where the materials are mixed.

WORKING

- The material to be mixed is introduced into the mixing tank.
- The motor rotates the shaft and attached paddles at low speed.
- As the paddles rotate, they push the material tangentially, creating a laminar flow that ensures uniform mixing
- The process continues until the desired level of homogenous product is achieved.



ADVANTAGES

- Effective for viscous materials
- Gentle Mixing
- Simple Design

DISADVANTAGES

- Limited for Low viscosity fluids.
- Energy consumption

APPLICATION

- Mixing pharmaceutical suspensions
- Blending ointments, creams

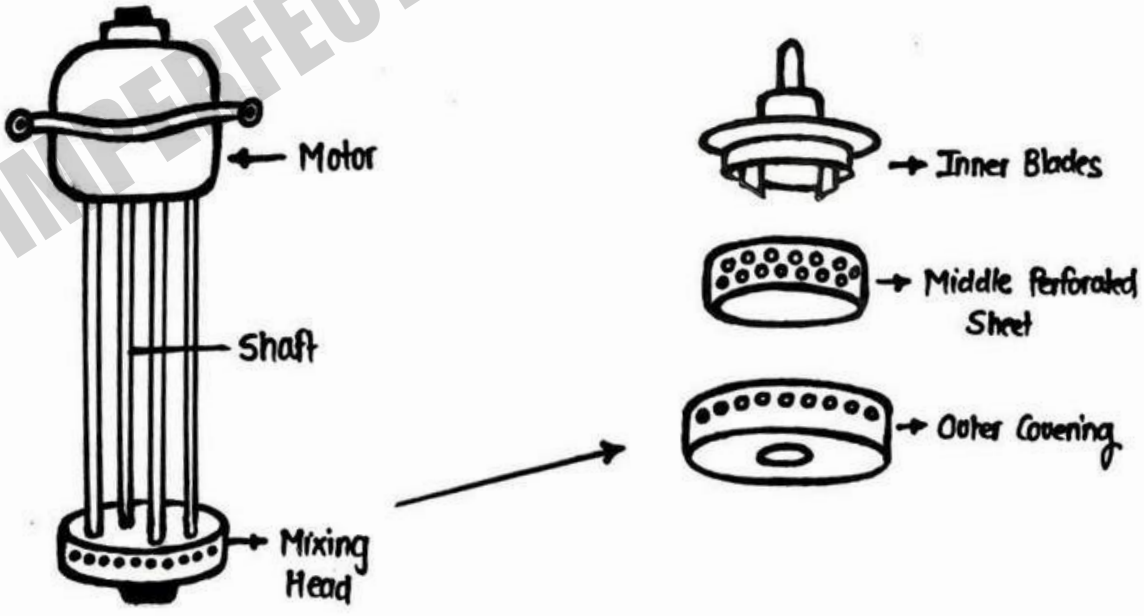
⑨ SILVERSON EMULSIFIER

PRINCIPLE

- The Silverson emulsifier operates on the principle of high speed shearing
- A rapidly rotating rotor generates intense shear forces and turbulence, which break down larger droplets into smaller ones, resulting in a fine and stable emulsion.

CONSTRUCTION

- Motor : Drives the central rotating shaft.
- Shaft : Connects the motor to the mixing head.
- Mixing Head : Located at the end of the shaft, it contains turbine blades surrounded by a perforated metal sheet (mesh) and an outer cover with openings.



WORKING

- The mixing head is fully immersed in the liquids to be emulsified.
- The motor spins the shaft and mixing head at high speed.
- The turbine blades create a pressure difference, drawing liquids into the mixing head.
- Inside the head intense mixing occurs, breaking down larger droplets.
- The process repeats, ensuring a proper mixing & uniform emulsion.

ADVANTAGES

- Rapid Mixing
- Versatility
- Particle size reduction

DISADVANTAGES

- Mesh clogging
- Energy consumption

APPLICATION

- Pharmaceuticals : Creams, emulsions.
- Cosmetics
- Food Industry

THANK YOU

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