Tablet Coating

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Tablet coating

Tablet coating is the last critical step in the tablet production cycle.
It is the phenomenon of application of coating to the tablet.

Objectives of Tablet Coating

- Mask the odour, taste or color of the drug.
- Provides physical and chemical protection for drug.
- Controls the release of drug from the tablet.
- Protects the drug from gastric environment of stomach in case of acid sensitive drug.
- Avoids chemical incompatibility.
- Improves pharmaceutical elegance by using colors and contrasting printing.

Components Considered In Tablet Coating

Tablet Properties- Shape, tolerance, Surface area

Coating process

- Coating equipment
- Coating parameters
- Facility & ancillary equipment
- Automation of coating process
- Coating composition which involves polymers, colour ,plasticizer ,solvent.

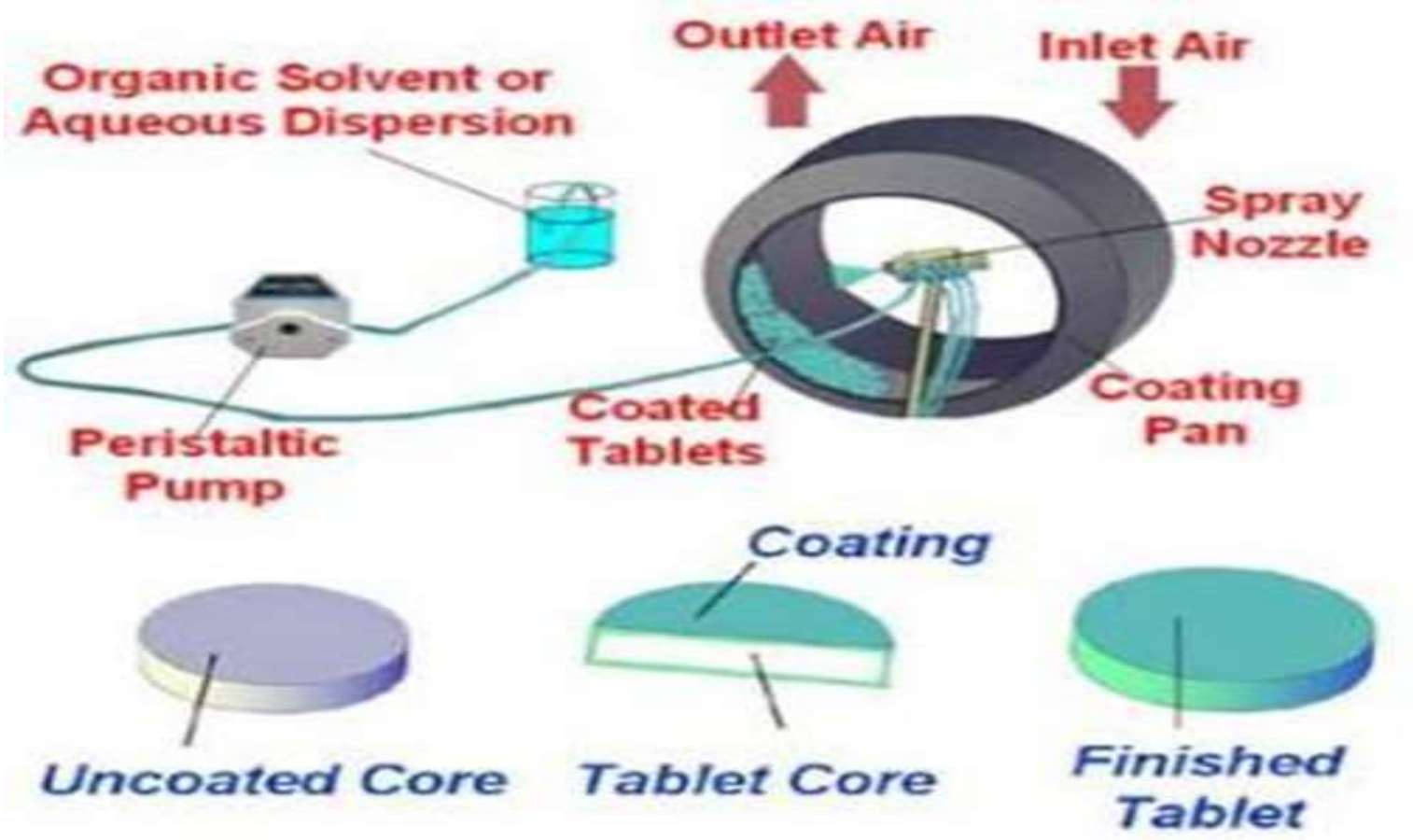
Tablet Properties

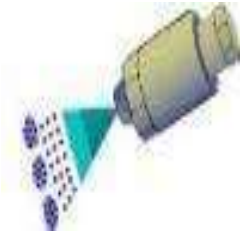
- Tablet to be coated must posses the proper physical characteristics like spherical shape and uniform surface.

- To tolerate attrition of tablets during coating process they must be resistant to abrasion and chipping.

- As the tablet surfaces that are brittle and soften in presence of heat or effected by coating composition and tend to become rough in the early stages of coating process are unacceptable for film coating.

Tablet Coating Process



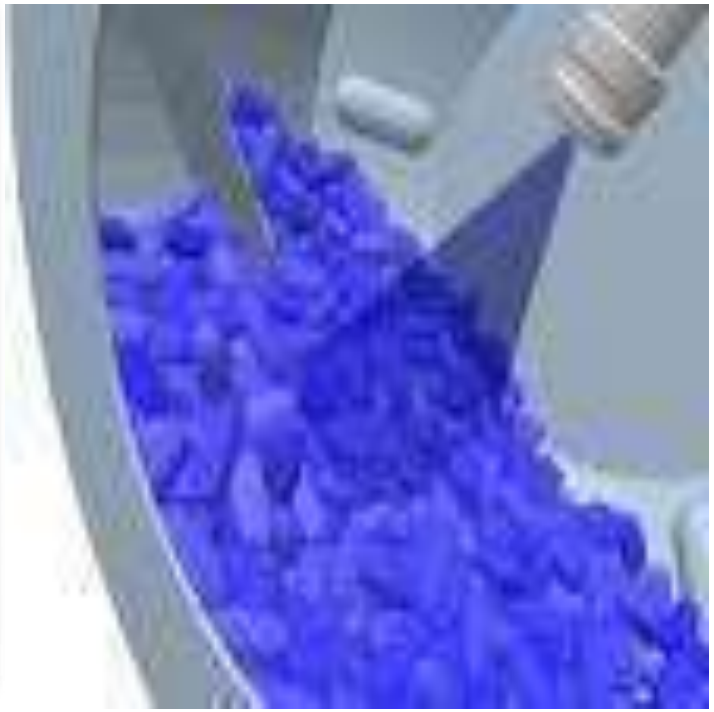


Wetting and Adhernce

Accumulation and Partial Drying

Spreading

Coalescence and Cohesion



Coating Process

Tablet coating is accomplished by the movement of tablets in Perpendicular or vertical direction to the application of the coating composition

Coating composition

Is Applied To

Moving bed of tablets

HEATED AIR IS INTRODUCED

Evaporation of the solvent

A. Equipment

The equipments used for the tablet coating are :-

- **Standard coating pan**
- **Perforated coating pan**
- **Fluidized bed coater**

Standard coating pan

Standard coating pan

- It is also known as conventional pan system
- Circular metal pan(mounted angularly on a stand)
- 8-60 inches in diameter
- Rotated on its horizontal axis by a motor
- Heated air is directed into the pan & on to the tablet bed surface and is exhausted by means of ducts through the front of the pan

Coating solution are applied to the tablets by ladling or spraying the material on to the rotating tablet bed.

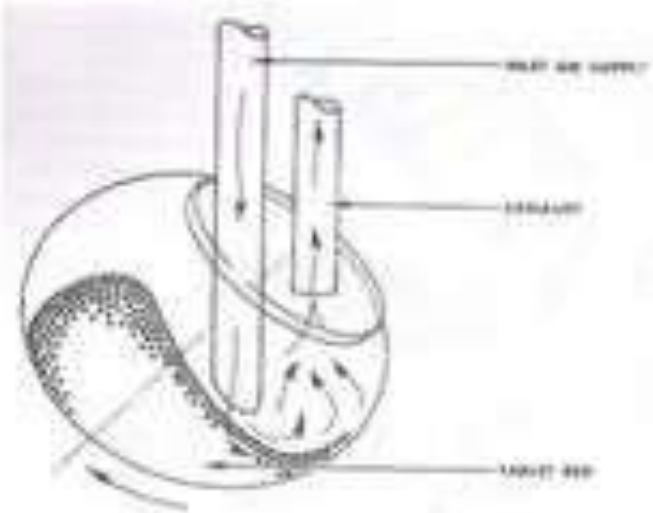
Use of spraying systems-

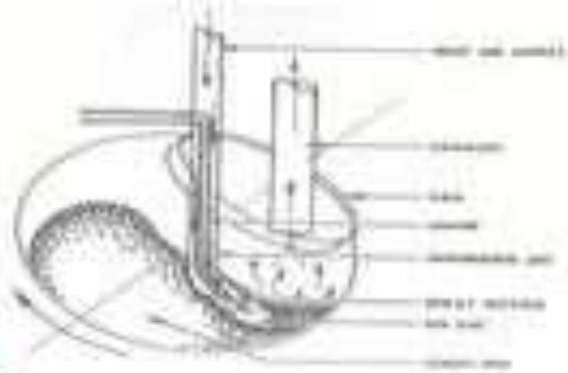
- Produces a faster, more even distribution of the solution or suspension.
- Reduces drying time between solution application in sugar coating .
- Allows continuous application of the solution in film coating.

In standard coating pan,the drying efficiency is improved by:-

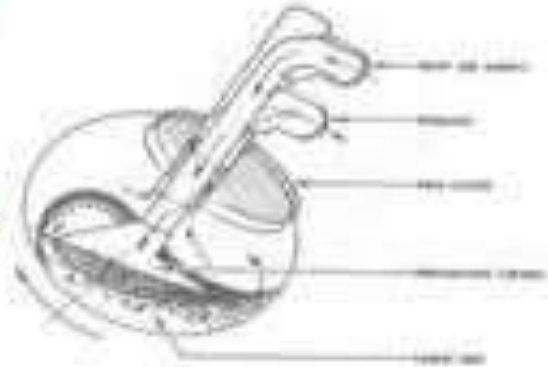
- Pellegrini pan
- The immersion sword
- Immersion tube systems

Standard Coating Pan





Immersion-tube system



Glatt Immersion sword system

Pellegrini pan system

Pellegrini pan-

- Baffled pan
- Diffuser(distributes the drying air uniformly over the tablet bed surface).

Immersion- sword system-

- Perforated metal sword device immersed in the tablet bed.
- Drying air is introduced through this device and flows upward from the sword through the tablet bed.

Immersion-tube system-

- Tube immersed in the tablet bed.
- Tube delivers the heated air.
- In immersion tube system the coating solution is applied with the heated air from the immersed tube

II. Perforated pan systems-

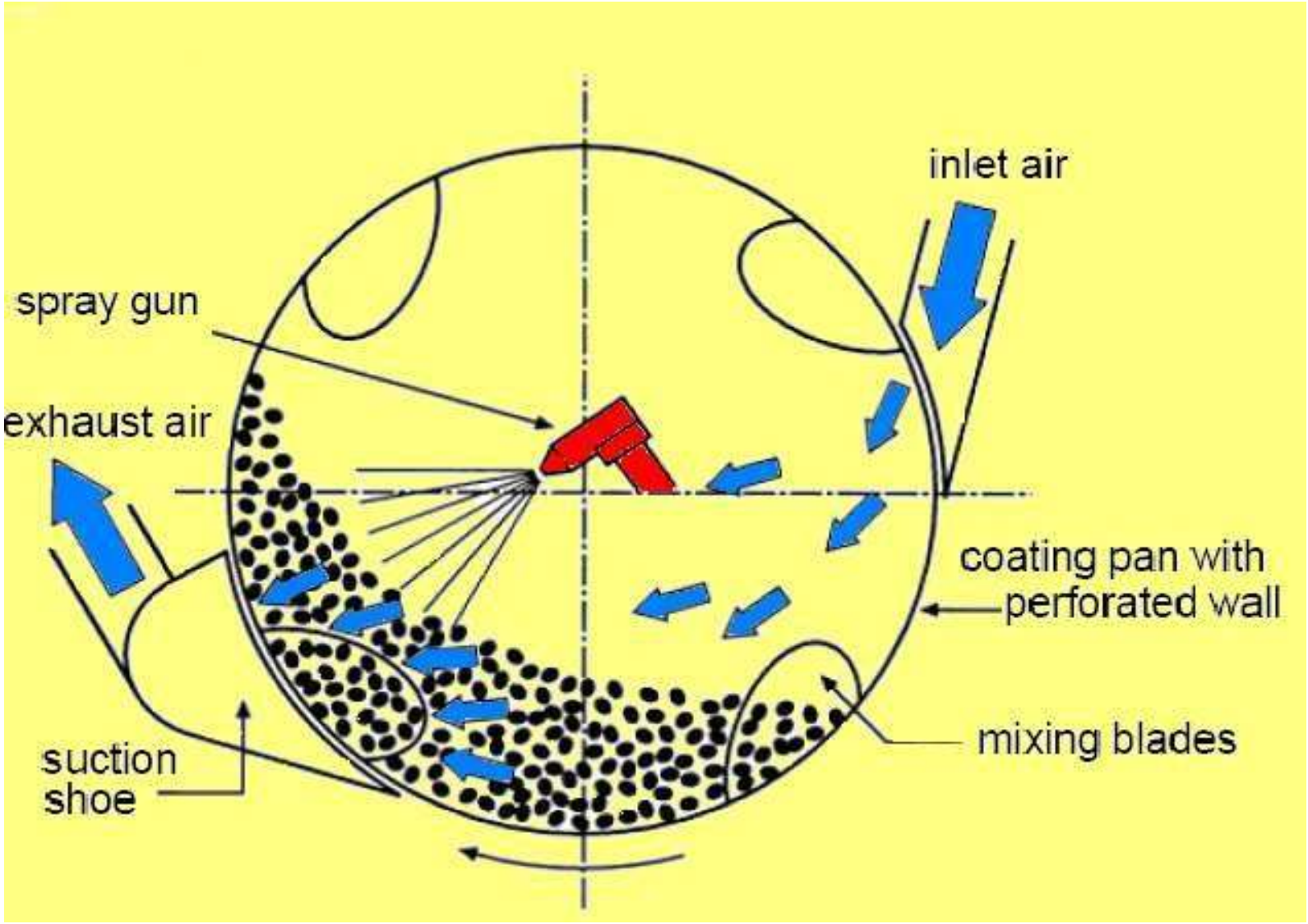
II. Perforated pan systems-

- Perforated or partially perforated drum.
- Rotated on its horizontal axis in an enclosed housing.
- The coting solution is applied to the surface of the rotating bed of tablets through spraying nozzles, which are present inside the drum.
- Perforated pan coaters are efficient drying systems with high coating capacity.

Perforated pan systems-

- Accela-cota system
- Hi coater system
- Dria coater pan
- Glatt coater

ACCELA-COTA


inlet air
spray gun
exhaust air
coating pan with
perforated wall
mixing blades
suction
shoe

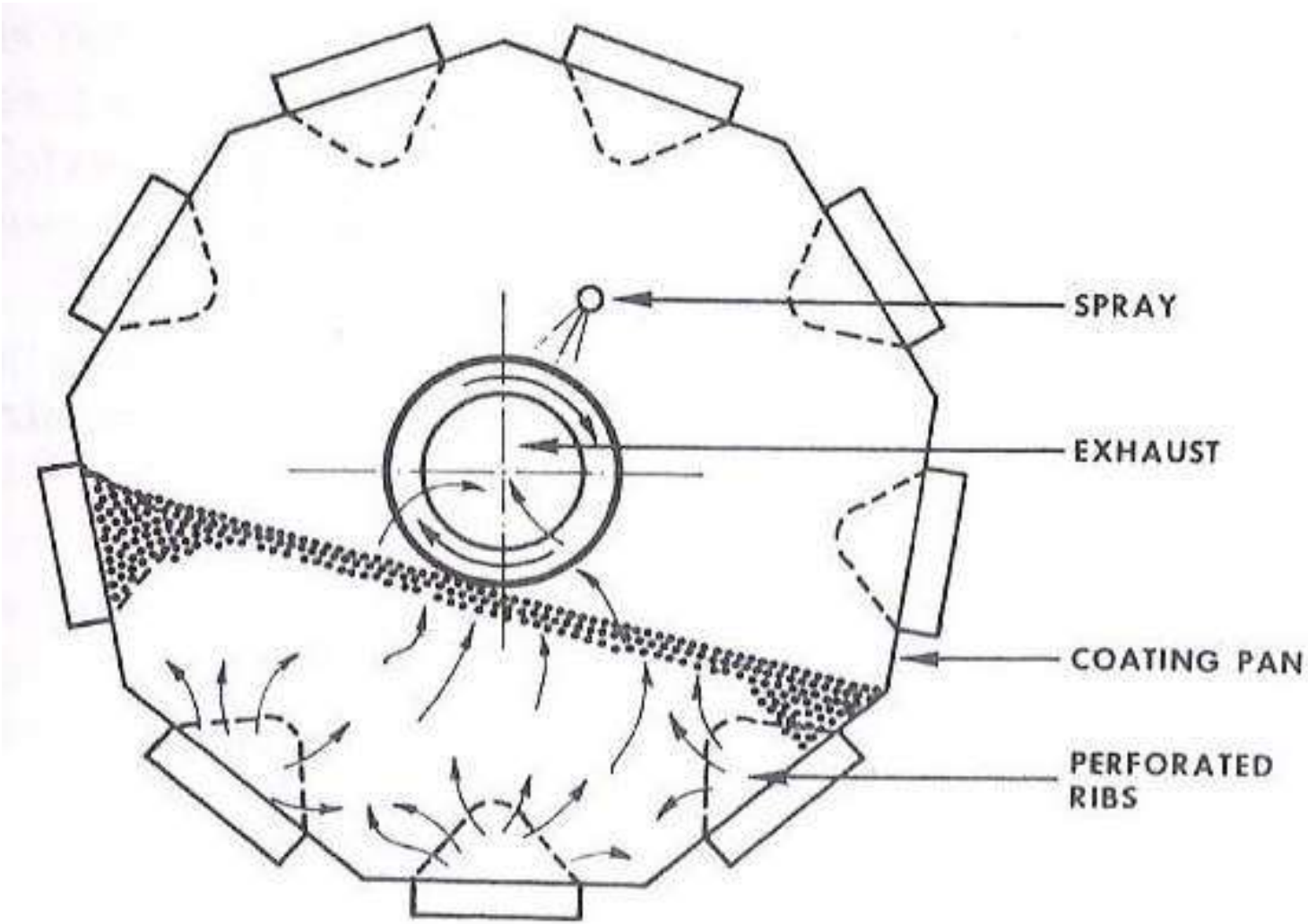
ACCELA COTA & HI COATER SYSTEM-

- Drying air is directed in to the drum,
- Passed through tablet bed,
- Exhausted through perforations in drum.

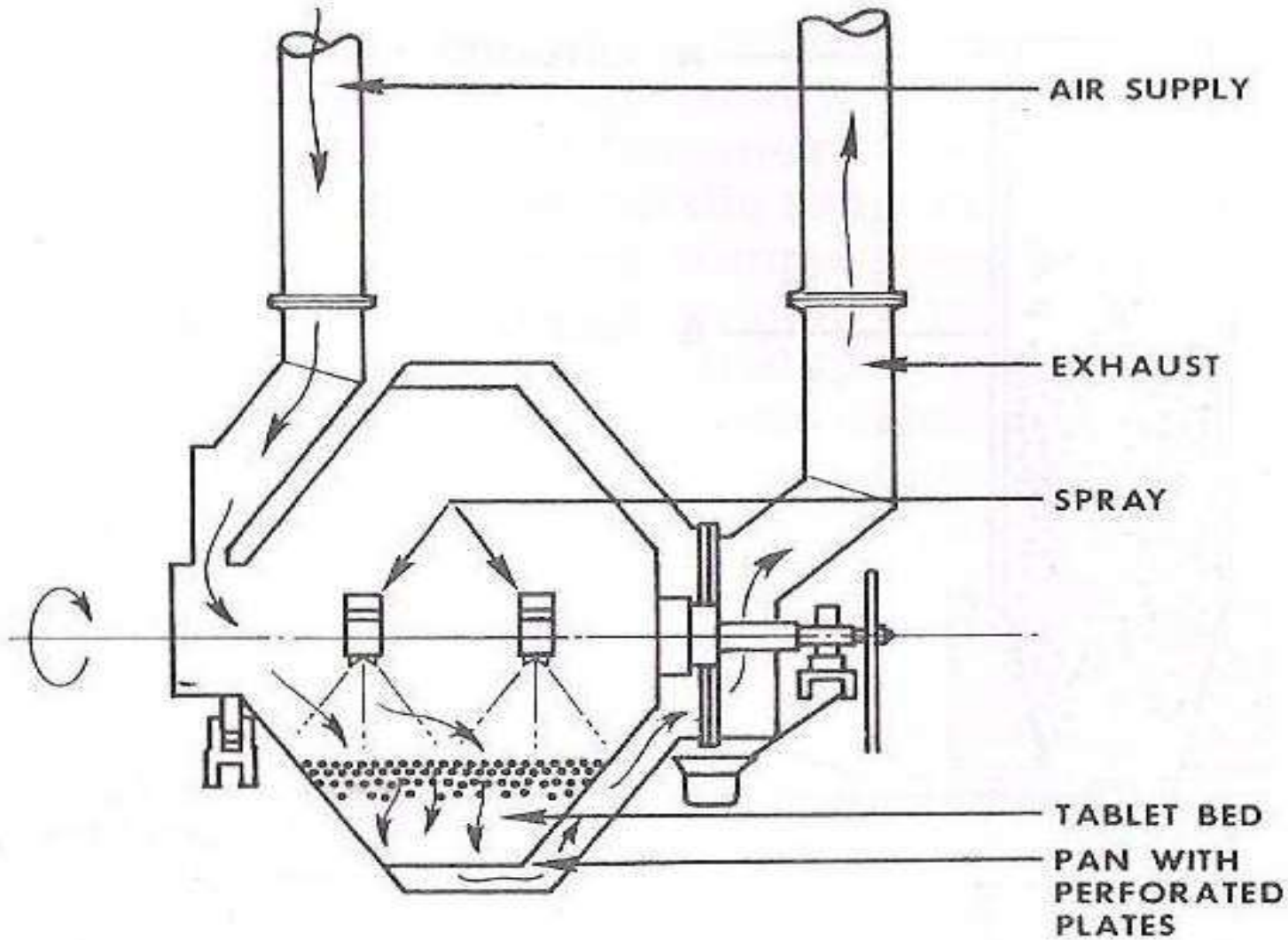
DRIACOATER PAN-

- Drying air enters through hollow perforated ribs ,located on inside periphery of the drum.
- As the coating pan rotates, the ribs dip into the tablet bed and drying air passes up through
- Exhaust is from the back of pan

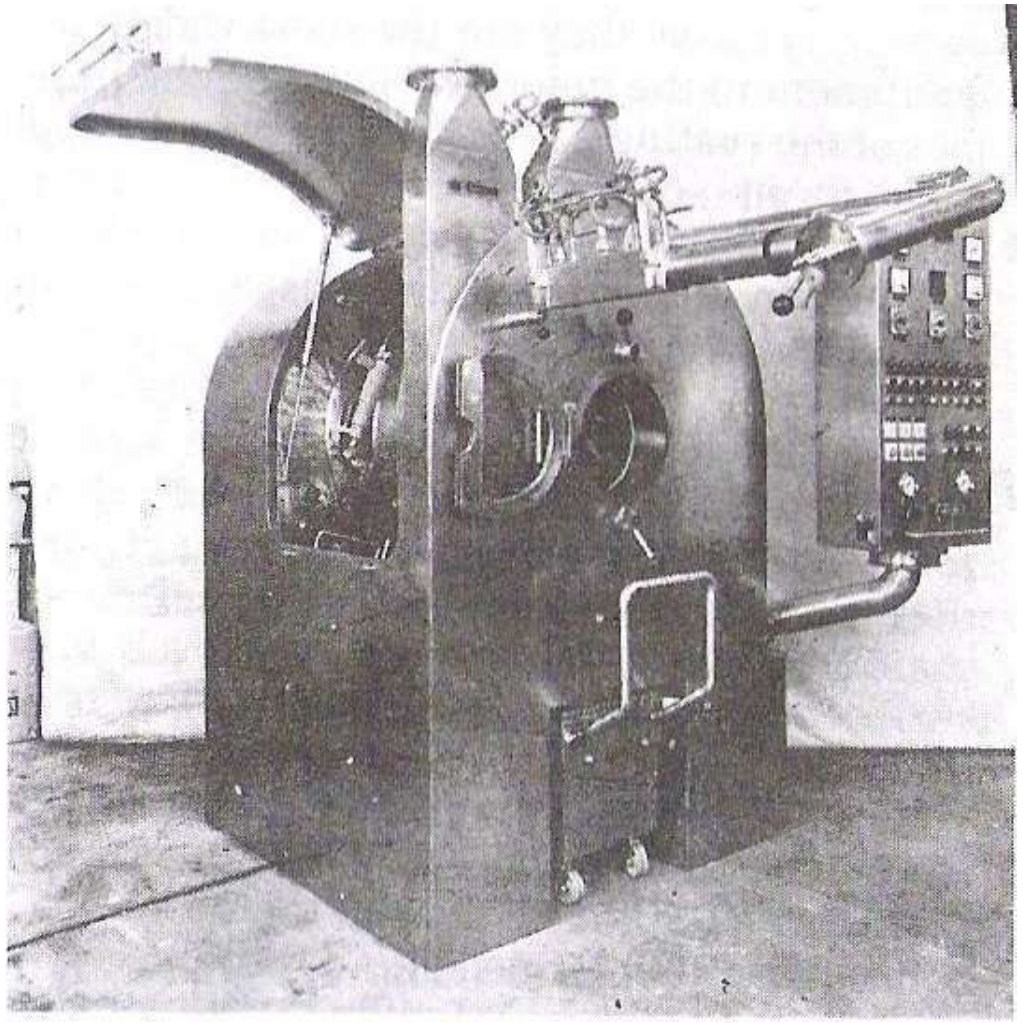
DRIA COATER PAN



HI-COATER SYSTEM



GLATT COATER



GLATT COATER

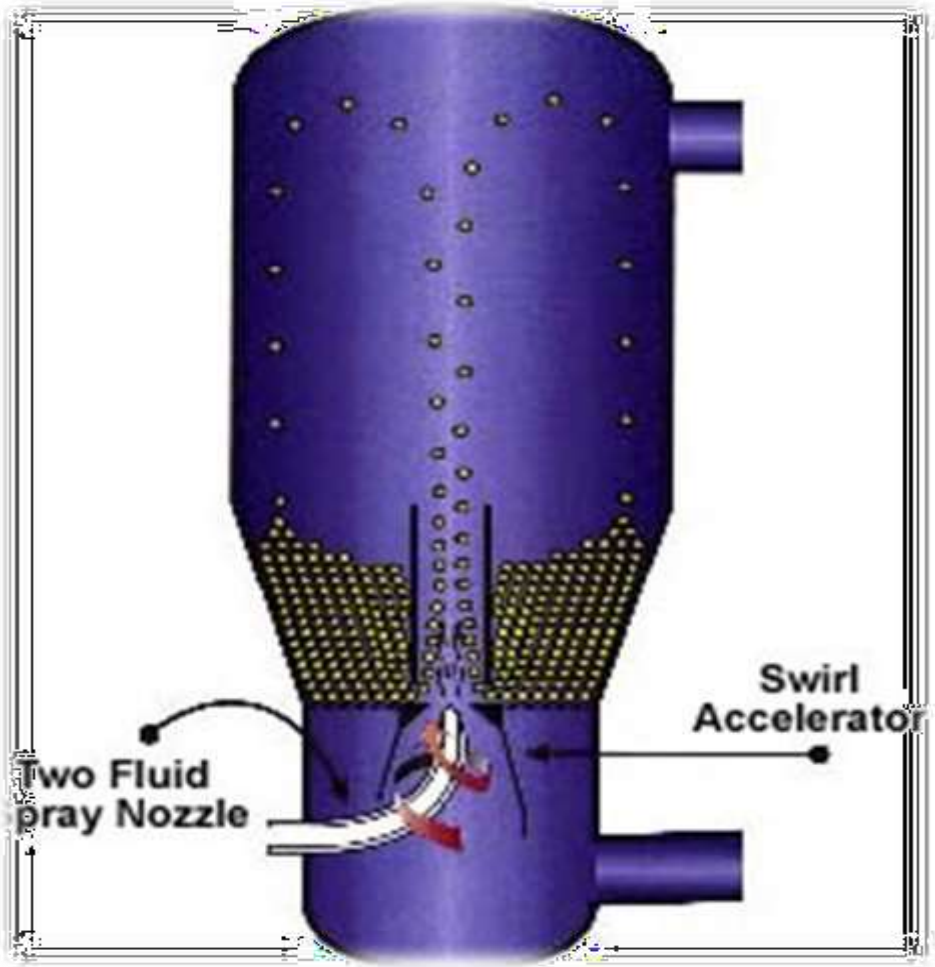
- It is the latest perforated pan coater to be introduced in the industry.
- In this, drying air can be directed from inside the drum through tablet bed
- Exhausted out through an exhaust duct.

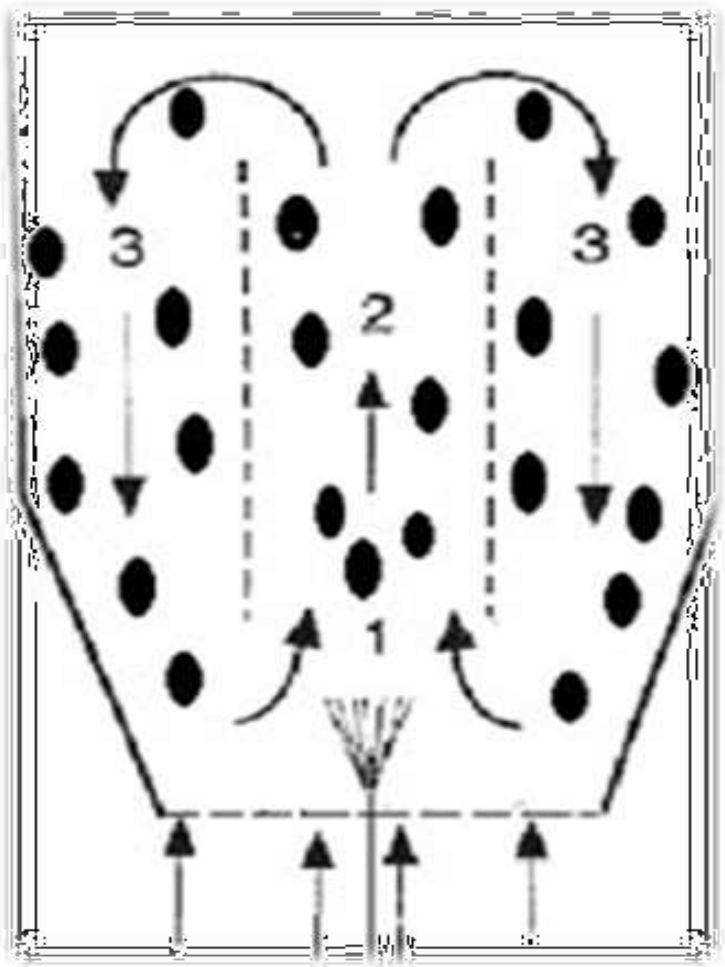
III. FLUIDIZED BED SYSTEM

III. FLUIDIZED BED SYSTEM

- In this system fluidization of the tablet mass is achieved in a columnar chamber by the upward flow of drying air.
- The air flow is controlled, so that more air enters the center of the column, causing the tablets to rise in the center.
- The movement of tablets is upward trough the center of the chamber.

FLUID BED COATING MACHINE MECHANISM





FLUIDIZED BED SYSTEM

- They then fall towards the chamber wall,

- Move downwards to reenter the air stream At the bottom of the chamber.

- Coating solutions are applied from a spray nozzle which is located at the bottom of the chamber.

{Or }

- are sprayed onto the top of the Cascading tablet bed by nozzles located in the upper region of the chamber.

SPRAY APPLICATION SYSTEM

2 Basic systems used to apply a finely divided (atomized) spray of coating solutions or suspensions on to tablet are-

* High pressure, airless
* Low pressure, air atomized

AIR LESSSPRAY SYSTEM-

Liquid is pumped at high pressure{250-3000 pounds per square inch gauge(psig) },through a small orifice (.009 inch to .020 inch) in the fluid nozzle Which results in a finelydivided spray.

In this ,the degree of atomization & the spray rate are controlled by

- Fluid pressure,
- orifice size and
- Viscosity of the liquid

LOW PRESSURE AIR- ATOMIZED SYSTEM

- Liquid is pumped through a somewhat large orifice (0.020 inch-0.060 inch in diameter) at relatively low pressure(5-50 psig)

- Low pressure air contacts with the liquid stream at the tip of the atomizer,& a finely divided spray is produced.

- The degree of atomization is controlled by the fluid pressure , Fluid cap orifice

  Viscosity of liquid Air pressure

  Air cap design.

TABLET COATING PROCESS

The coating of tablets classified into three types

I. Sugar coating
II. Film coating
III. Enteric coating

SUGAR COATING

- It involves the application of sugar solution with color for several times to give -
- Uniform and Elegant Film.

ADVANTAGES

- It prevents unpleasant odour,
- Give sweet taste to tablet by masking bitter taste,
- Highly elegant and glossed tablets are obtained.

DURATION ---HOURS-FEW DAYS

Sugar coating involves following steps -

- ✓ Sealing
- ✓ Sub-coating
- ✓ Syruping(smoothing)
- ✓ Finishing
- ✓ Polishing

- The tablet having deep convex surfaces with thin rounded edges are suitable for sugar coating.

- In sugar coating, the tablet should be resistant to breakage, chipping, and abrasions.

- Because sugar coating tends to be long and vigorous.

1.SEALING

- It prevents moisture penetration in to the tablet core.

- Seal coating agents -shellac,zein,Oleicacid,PG,PEG4000,alcohol,methylene chloride.

- Zein is alcohol-soluble protein derivative.

- Shellac is more effective(because of polymerization of shellac), But it lengthens tablet disintegration and dissolution times.

Over wetting of tablet

Moisture is absorbed

Leads to

Tablet softening or disintegration

and effects

Physical and chemical stability

(To over come this problem seal coating is done)

2.SUB COATING

Sub coating is applied :

- To form uniform edges,
- To build up the tablet size.

Sub coating increases the tablet weight from 50 to 100 percent.

Examples-

Gelatin, sugarcane powder, corn syrup, syrup , distilled water, Gum acacia.

It involves

Application of binder solution

To the

Tablets

followed by

Dusting of sub coating with powders

and drying until

the tablet edges have been covered

&

The desired thickness is achieved.

3.SYRUPING

It is done to cover the imperfections in the Tablet surface caused during sub coating step.

It involves-

- Application of syrup coating with grossing syrups followed by the addition of dilute colorants to provide tinted base.
- In subsequent steps, the syrup solution containing dye are applied until final size and Color are achieved.
- The final step a clear syrup coat without dye are applied.

- No colour is added until the tablets are quit smooth, Premature application to the rough tablets can produce a Mottled appearance in the final coated tablets.

- Syrup coating constituents- colorant , sub coating powder , calcium carbonate ,cane sugar powder, corn starch, syrup , distilled water.

4.POLISHING

The desired luster to the tablet is obtained by polishing .

Tablets are polished

in a

Standard coating pans

by application of

carnauba wax(yellow), bees wax(white),paraffin wax (Or) warm solutions of waxes in naphtha (or) suitable volatile solvent.

FILM COATING

It is the process of polymeric solution to bring a uniform film.

Advantages

- Film coating gives a tablet with less Weight and small size.
- The film formed is very thin.
- In film coating engravings are possible on tablet surface which are not possible in sugar coating.
- Better mechanical strength is obtained.
- The cost of the film coated tablets is less.

FILM FORMING AGENTS

The film forming agents tablet coating are classified into:

1.Non - enteric film formers

2.Enteric film formers

NON-ENTERIC FILM FORMERS

- They are incorporated to give uniform film with desired mechanical strength which are as follows:
    1. HPMC(Hydroxy propyl methyl cellulose)
    2. MHEC(Methyl hydroxyl ethyl cellulose)
    3. EC(Ethyl cellulose)
    4. HPC(Hydroxy propyl cellulose)
    5. POVIDONE
    6. SCMC
    7. PG
    8. ACRYLATE POLYMERS

1. HPMC

- It is prepared by reacting alkali treated cellulose with methyl chloride with propylene oxide.

- As it forms bridging & rough Tablet surface, it has to be mixed with other polymers or plasticizers.

2.MHEC

- It is prepared by reacting alkali treated cellulose with methyl chloride & then with ethylene oxide.
- It has similar properties as that of HPMC,
- But it is soluble in fewer organic solvents, it is not used as frequently as HPMC .
- These polymers used in combinations with other polymers to modify film Properties.

For Example-

Combinations of PG waxes with Cellulose acetate phthalate provide film that are soluble in GI fluids.

3.EC

- It is manufactured by the reaction of ethyl chloride with cellulose dissolved in NaOH.
- It is available in different viscosity grades.
- Unplasticized EC forms brittle films & requires film modifiers to obtain acceptable film.
- It is water insoluble & thus Cannot be used alone for tablet coating.
- It is usually <u>combined with water Soluble additives</u>

<u>Eg.</u> HPMC to prepare film with reduced water soluble Properties &This combinations are widely Used in sustained release coating.

4.HPC

- It is manufactured by the treatment of cellulose with NaOH followed by the reaction with propylene oxide at Elevated temperature and pressure.

- It forms tacky films

- Used in combinations with other polymers to improve film characteristics.

- It is soluble in water (below 40℃ & insoluble above 45°c) , GI fluids & in many polar Organic solvents.

5.POVIDONE

- It is synthetic polymer consisting of linear 1-vinyl-2-pyrrolidinone groups.
- It gives clear, glossy, hard films when dry.
- It give tacky films which can be overcome by plasticizer or other polymer.

6.ACRYLATE POLMERS

- These are marketed under the trade Name of Eudragit.
- Eudragit RL & RS are copolymers of Acrylic and meth acrylic acid esters.
- These films produce pH independent, delayed actions.
- Preparation is similar to that of EC formulations

ENTERIC FILM FORMERS

Reasons for enteric film formers-

- To protect acid-labile drugs from gastric fluid e.g. Enzymes & certain Antibiotics.
- To prevent gastric distress or nausea due to irritation from the drug . e.g., Sodium salicylate.
- To deliver drugs intended for local Action in the intestines, e.g. Intestinal antiseptics.
- To deliver drugs that are optimally Absorbed in the small intestine to their primary absorption site.
- To provide a delayed-release component for repeat-action tablets.

Properties of an ideal enteric coating material

- Resistance to gastric fluids.
- Susceptibility or permeability to intestinal fluids.
- Compatibility with most coating solution components & the drug substrates.
- Stability alone and in coating solution. The film should not change on aging.
- Formation of a continuous film, nontoxicity, with low cost.
- Ease of application without Specialized equipment.
- Ability to be readily printed and allow film to be applied to debussed tablets.

ENTERIC FILM FORMERS

- CAP(Cellulose acetate phthalate)
- ACRYLATE POLYMERS
- HPMCP(Hydroxypropyl methyl cellulose phthalate)
- PVAP(Polyvinyl acetate phthalate)

1.CAP

- It is widely used.

- As it is hygroscopic and relatively permeable to moisture and gastric Fluids, film formed **are brittle and** hence formulated with hydrophobic- Film forming materials to achieve better enteric films.

- **Aquateric coating** is a reconstituted colloidal dispersion of latex particles. It is Composed of solid or semisolid polymer spheres of cap ranging in size from 0.05-3 Microns with an a average particle size of 0.2 microns

2.ACRYLATE POLMERS

2 forms of commercially available Enteric acrylic resins are **Eudragit L and Eudragit S.**

Eudragit l is available as an organic Solution, solid or aqueous dispersion.

Eudragit s is available only as an organic solution and solid.

Eudragit l & s are soluble in intestinal Fluid at pH 6&7.

3.HPMCP

- It is derived from HPMC by esterification with phthallic anhydride.
- These are stable than can and dissolve at lower pH compared to cap and acrylate polymers.
- The solubility characteristic may result in Higher bioavailability of some specific drugs.
- It is available in various grades-HP55,HP50 etc.

4 PVAP

- It is manufactured by the esterification of partially hydrolyzed Polyvinyl alcohol with phthallic Anhydride.

- It is similar to HPMCP(HP55) in stability and pH dependent solubility.

COATING SOLUTION COMPOSITION

It involves

1. Solvent
2. Plasticizers
3. Colorants
4. Opaquant-extenders

1.SOLVENT

- It is to dissolve or disperse the polymers and other additives and convey them to the substrate surface.

- **The ideal requirements of the solvent are**
  - ✓It should either dissolve or disperse the polymer system.
  - ✓It should have no environmental impact.
  - ✓It should easily disperse other coating solution components in to the solvent system.
  - ✓It should have rapid drying rate(ability to coat 300kg load in 3-5 hours)
  - ✓It should be Colorless, tasteless, odorless, Inexpensive, nontoxic, inert and Noninflammable
  - ✓Examples-
    Water, Ethanol, Methanol, Isopropanol, Chloroform, Acetone, Methylene chloride , Methylene ethyl ketone.

2.PLASTICIZERS

- It is used to modify the quality of the film .

- Plasticizing techniques involve internal plasticizers and external plasticizers.
- Internal plasticizers---involves Chemical modification of the basic polymer that alters the physical properties of the polymers.
- Chemical plasticizers--Additives of the Coating solution to achieve the desire effect of the film (flexibility ,tensile Strength, adhesive properties)
- Level of plasticizers ranges from 1-50% by weight of film former.
- **Examples**

  Castor oil, Propylene glycol,Glycerin, Surfactants

  Polysorbate(tweens),sorbitan esters(spans),

  organicacid esters.

3.COLORANTS

- It is to provide the distinct color and Elegance to the dosage form.

- To achieve the proper distribution of suspended colorants in the coating solutions requires. Use of fine powdered colorants (<10 microns)

- The concentration of colorants in the coating solution depends on the color shade, desired the type of dye and the concentration of the opaquqnt extenders

- For very light shade conc. Lt 0.01%
- For dark shade Conc. Mt 2.0% is required.
- The most common colorants in use are certified by FOOD DRUG AND COSMETICS (FD&C) or DRUG AND COSMETIC (D&C) Colorants.
- These are lakes and dyes.
- Lakes are derived from dyes by precipitating with carriers e.g., Alumina or talc.

- The inorganic materials and the natural colorants are-
  - Iron oxides,
  - Caramel,
  - Carotenoid,
  - Chlorophyll, indigo,
  - Flavones,
  - Turmeric and carminic acid.
- A variety of products that are Commercially available are-
  - **Opalux-** Opaquant color concentrate for sugar coating.
  - **Opaspray** -for film coating.
  - **Opadry-**complete film coating concentrate.

OPAQUANT-EXTENDERS

- These are very fine inorganic powders used In the coating solution formulation to provide more pastel colors and increase film coverage.

- Provide white coating or mask the color of the tablet core.

Examples-

Titaniundioxide Silicates like (Talc, Aluminiumsilicate) Carbonates like-magnesium carbonate, Sulphates like calcium sulphate.

Tablet coating defects and remedies

1.Blistering- It is a coating defect where the film becomes detached from the substrate forming a blister.

	Causes	Remedies
1.	**Entrapment of gases or vapor in or under the film due to overheating either during spraying or at the end of the coating.**	**Use mild drying conditions.**
2.	**Effect of temperature on the adhesion, elasticity, and strength of the film.**	**Use mild drying conditions.**

2.Blooming/Dull film

- It is a coating defect where the coating becomes dull immediately or after prolonged storage at high temperatures. In other words, it is the fading or dulling of a coated tablet color after a prolonged period of storage at a high temperature. In other words, it is the fading or dulling of a coated tablet color after a prolonged period of storage at a high temperature.

	Causes	Remedies
1.	**High concentration of plasticizer.**	**Use lower concentration of plasticizer.**
2.	**Low molecular plasticized coating system.**	**Use high molecular weight of plasticizer.**

3. Blushing

- It is a coating defect where whitish specks or haziness in the film appear. In other words, it is a haziness or appearance of white specks in the film coated tablet

Causes		Remedies
1.	Precipitation of coating polymer due to use of a poor vsolvent or high coating temperature	Decrease the drying air temperature.
2.	Use of sorbitol in coating formulation which causes major fall in the thermal gelation temperature of the HPMC (Hydroxy Propyl Methyl Cellulose), HPC (Hydroxy Propyl Cellulose), Cellulose ethers, and Methyl Cellulose.	Avoid the use of sorbitol with HPMC (Hydroxy Propyl Methyl Cellulose), HPC (Hydroxy Propyl Cellulose), Cellulose ethers, and Methyl Cellulose.

4.Cratering

- It is a coating defect of the film where volcanic-like craters appear on the tablet surface. In other words, it is a defect in the film's coating results in craters appearing on the tablet which in turn results in the exposure of the tablet's surface.

	Causes	Remedies
1.	**Penetration of coating solution at the surface of the tablet, often at the crown where the surface is more porous causing localized disintegration of the core.**	**Decrease the spray rate and use optimum drying conditions.**
2.	**Inefficient drying.**	**Use optimum drying conditions.**
3.	**Application of higher rate of the coating solution.**	**Decrease spray application rate.**
4.	**Low the viscosity of the coating solution.**	**Increase viscosity of coating solution.**

5. Cracking/Splitting

- It is a coating defect in which the film either cracks across the crown of the table (cracking) or splits around the edges of the tablet (Splitting).

	Causes	Remedies
1.	Higher internal stresses in the film than the tensile strength of the film.	Adjusting the type and concentration of plasticizer.
2.	High molecular weight polymeric blends or polymers.	Use lower molecular weight polymeric blends or polymers
3.	Coating and core have different thermal expansion properties.	Avoid mineral type excipient.
4.	Expansion of core due to overheating.	Avoid overheating the tablet core.
5.	Low mechanical strength of the coating.	Use coating with proper mechanical strength.
6.	Inadequate coating formulation.	Use proper coating formulation.
7.	Insufficient plasticization or too much pigmentation.	Use adequate plasticizer or pigment.

6. Color variation

- **It is a coating defect that involves variation in color of the film. In other words, color variation is a coating defect where visible differences in color of film found from tablet to tablet**

Causes		Remedies
1.	Inadequate mixing of tablets.	Use geometric mixing.
2.	Poor opacity of suspension.	Increase the opacity of suspension.
3.	Inadequate coating or migration of soluble dyes-plasticizers and other additives during drying.	Use formulation with various plasticizers and additives or use optimum drying conditions.
4.	Poor spray gun set up.	Correct gun set up.
5.	Low/high pan load.	Load the right quantity of tablets.
6.	High core friability.	Decrease core friability.
7.	Insufficient number of spray guns.	Increase the number of spray guns.
8.	High coating suspension solid.	Reduce suspension solid level.
9.	Low hiding power of coating suspension.	Use coating formulation with increased hiding

7. Chipping/ Edge Erosion: a common tablet coating defect

- **It is a coating defect where the film becomes chipped or worn away and dented usually at the edges of the tablet as the coating is being applied**

	Causes	Remedies
1.	Pan loading with insufficient amount of core tablets.	Pan fill with sufficient amount of core tablets.
2.	Inappropriate baffles design.	Use appropriate baffles design
3.	Low coating film strength.	Use high film strength coating formula.
4.	Pan speed too fast.	Use correct pan speed.
5.	Worn tablet punch/tooling.	Replace tablet tooling.
6.	Sharp edge on tablets.	Use proper tablet shape.
7.	Low spray rate.	Use an optimum spray rate.
8.	Low coating suspension solid.	Increase suspension solid level.
9.	High degree of attrition related to the coating process.	Increase the hardness of the film by increasing the molecular weight of the coating polymer.

8.Core Erosion/ Surface Erosion

- It is a coating defect where tablet surfaces erode as tablets tumble during the coating process. Especially this problem has happened with the presence of inappropriate logo

	Causes	Remedies
1.	Hygroscopic tablet core.	Reduce the amount of hygroscopic excipient such as disintegrant.
2.	Spray rate is too high or low.	Use appropriate spray rate.
3.	Pan speed too high.	Use correct pan speed.
4.	High friability of core tablet.	Use less friable tablet.
5.	Insufficient film strength to provide resistance to edge damage.	Use high film strength.
6.	Poor punch design.	Use high quality punch.
7.	Punch wear.	Use a non-wear punch.
8.	Poor logo design or placement.	Use proper logo design.
9.	Low coating suspension solid.	Increase suspension solid level.

9. Discoloration

- **It is a rare coating defect where discoloration is appeared either through or on the coating caused by interactions of ingredients in the core or by heat from the process causing ingredients in the core to migrate through the coating. The problem is commonly seen with nutraceutical products**

	Causes	Remedies
1.	Sprayable coating solids are too low.	Use film coating formula with higher solids.
2.	Less protection by film from moisture during storage.	Use a coating formula that provides enough protection from moisture.
3.	Very high spray rate with low temperature.	Decrease spray rate and/or increase processing temperatures.
4.	Low pan speed.	Increase pan speed to lessen dwell time.
5.	Migration and melting of ingredients in the core.	Increase spray rate and/or reduce processing temperatures.

10.Logo Bridging

- It is a coating defect where coating bridges formed across a logo or break line. As more coating is applied to tablet surfaces, the stresses that develop within the coating as it dries overcome the forces of attachments of the coating to the tablet surface, causing the coating to pull away within the logo or break line, making either less visible

Causes		Remedies
1.	Poorly plasticized coating system.	Use optimally plasticizer coating.
2.	Low adhesion coating system.	Use high adhesion coating.
3.	Low adhesion core ingredients	Use high adhesion core ingredients.
4.	Spray rate too high.	Reduce spray rate.
5.	Product temperature too low.	Increase temperature.
6.	Poor logo design.	Improve logo design.

11. Logo In-filling /Break Lines In-filling

- It is a coating defect where the engraved logo or break line filled with either particle of dried polymer or
- solidified foam. Coating droplets are over-dried before contacting tablet surface, increasing tablet surface roughness and filling the logo.

	Causes	Remedies
1.	High atomizing air pressure.	Reduce atomizing air pressure.
2.	High drying air temperature.	Reduce drying air temperature.
3.	High coating suspension solid.	Use a low viscosity coating suspension.
4.	Too high gun to bed distance.	Optimize gun to bed distance.
5.	Poor spray gun design.	Use proper spray gun design
6.	Turbulent air flow.	Minimize pan depression.
7.	Aeration of coating suspension.	Use optimized suspension preparation to avoid aeration.
8.	Poor logo design.	Improve logo design.
9.	Excessive foaming of the coating solution.	Improve the mixing process.
10.	Foam and Bubble formation because of air spraying of a polymer solution.	Add alcohol or use spray nozzle capable of finer atomization.
11.	Over drying of spray.	Optimum drying of spray.

12.Orange Peel (Roughness)

- **It is a coating defect where the surface of the applied film coating is extremely rough and nonglossy, often taking on the appearance of the skin of an orange.**

Causes	Remedies
Rapid Drying.	Use mild drying conditions.
Too high coating suspension viscosity.	Reduce the viscosity coating suspension.
Too low atomizing air pressure.	Increase Atomizing air pressure.
High spay rate/ Over-wetting.	Decrease spray rate.
Poor spray gun performance.	Use better spray guns.
Inadequate distribution of the coating suspension.	Decrease in viscosity of coating suspension.
Very close gun to bed distance.	Adjust gun to bed distance.

13.Pitting

- **It is a coating defect where pits appear on the surface of a tablet core without any visible disruption of the film coating. In other words, pitting is the deformation of the core of the tablet without any visible signs of disruption of the film coating**

	Causes	Remedies
1	Inappropriate drying (inlet air) temperature.	Use appropriate drying (inlet air) temperature.
2	Melting or dissolution of lubricant on tablet surface or melting of core ingredient due to high core temperature.	Use control drying temperatures.

14. Peeling

- It is a coating defect where peels off the tablet during or after the coating process. Peeling refers to the formation of uneven or rough irregularities on the surface of a coating film applied on a core tablet surface

	Causes	Remedies
1.	Low adhesion core ingredients.	Use high adhesion core ingredients.
2.	Low mechanical strength of the coating.	Use proper composition with improved mechanical strength.
3.	Low adhesion coating system.	Use high adhesion coating.
4.	Coating is rubbing off due to excessive attritional effects.	Reduce pan speed.

15. Sticking and Picking

- It is a coating defect where part of film of tablets momentarily stick together or stick to the pan, often just after they pass through the spray zone, and then sticked area being detached from the tablet surface

Sr.No	Causes	Remedies
1	Inadequate drying.	Use optimum drying conditions.
2	High viscosity of coating solution.	Increasing viscosity of coating solution.
3	Spray rate too high.	Reduce spray rate.
4	Too low drying air volume	Increase air volume.
5	Too low drying air temperature.	Increase the inlet air temperature.
6	Pan speed too low.	Increase pan speed.
7	Low atomization pressure.	Increase atomization pressure.
8	Poor spray gun set up.	Improve spray gun setting.
9	Surface solubility.	Increase gun to bed distance.
10	High tablet surface porosity.	Improve core characteristics.

Thank You