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Review Article
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TABLET COATING INDUSTRY POINT VIEW- A COMPREHENSIVE REVIEW

*B.VENKATESWARA REDDY, K. NAVANEETHA, B.RASHMITHA REDDY
Department of Pharmaceutics, St.Paul's College of Pharmacy,
Turakayamjal village, Hayath Nagar Mandal, Ranga Reddy Dist-501510, A.P.
*Corresponding Author Email:

ABSTRACT

Tablet Coating is a process by which an essentially dry, outer layer of coating material is applied to the surface of a dosage form in order to confer specific benefits over uncoated variety. The advantages of tablet coating are taste masking, odor masking, physical and chemical protection, protection of the drug from the gastric environment etc. The important reason to coat a pharmaceutical dosage form is to control the release profile and bioavailability of the active ingredient. The various techniques of coating such as sugar coating, film coating, enteric coating. The amount of coating solution applied and the thickness of the coating layer determines the release of the drug from the delivery system. Tablets are usually coated in conventional coating pans by spraying the coating solution on the free surface of the tablet bed and subsequent drying of the solution. The main focus of this review is, to study various key factors associated with coating, , latest techniques of coating such as dip coating, laminated coating, electrostatic, vacuum film coating and problem encountered during the coating process.

KEY WORDS

Tablet coating, laminated coating, Pharma industry, gastric environment, bioavailability.

INTRODUCTION

TABLET:

A tablet is a pharmaceutical dosage form. It comprises a mixture of active substances and excipients, usually in powder form, pressed or compacted into a solid**.** Tablets Dosage form is one of a most preferred dosage form all over the world. Almost all drug molecules can be formulated in a tablet and process of manufacturing of tablets is very simple, and is very flexible. One can administered 0.01 mg of a drug dose to 1 gm of a drug dose by oral route of administration, by formulating as a tablet.

TABLET COATING:

Coating is a process by which an essentially dry, outer layer of coating material is applied to the surface of a dosage form in order to confer specific benefits over uncoated variety.

Coating may be applied to a wide range of oral solid dosage form, such as particles, powders, granules, crystals, pellets and tablets. When coating composition is applied to a batch of tablets in a coating pan, the tablet surfaces become covered with a tacky polymeric film. Before the tablet surface dries, the applied coating changes from a sticky liquid to tacky semisolid, and eventually to a nonsticky dry Surface pans. The entire coating process is conducted in a series of mechanically operated acorn-shaped coating pans of galvanized iron stainless steel or copper. The smaller pans are used for experimental, developmental, and pilot plant operations, the larger pans for industrial production.

Objectives to coat a tablet

THERAPY

- To avoid irritation of oesophagus and stomach
- To avoid inactivation of drug in the stomach
- To modify the drug release
- To improve patient compliance
- To mask the bitter taste

TECHNOLOGY

- To decrease the influence of moisture and atmosphere.
- Reduces the risk of interaction between incompatible material
- Improve the drug stability
- To prolong the shelf life of the drug

MARKETING

- To avoid bitter taste
- To improve product identity
- To improve the appearance and acceptability
- In improving product robustness

Disadvantages of tablet coating

- Disadvantages of sugar coating such as relatively high cost, long coating time and high bulk have led to the use of other coating materials.
- However the process of coating is tedious and time-consuming and it requires the expertise of highly skilled technician.

KEY FACTORS

1. TABLET PROPERTIES

- Shape
- Tolerance
- Surface area

2. COATING PROCESS

- Equipments
- Parameters
- Facility and ancillary equipment
- Automation

3. COATING COMPOSITION

- Polymers
- Solvents
- Plasticizers
- Colorants

1. TABLET PROPERTIES

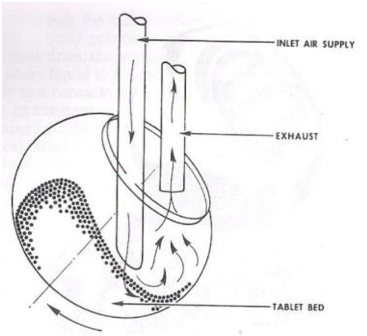
- Tablets that are to be coated must possess the proper physical characteristics. In the coating process, the tablets roll in a coating pan or cascade in the air stream of an air suspension coating as the coating composition is applied.
- To tolerate the intense attrition of tablets striking other tablets or walls of the coating equipment, the tablets must be resistant to abrasion and chipping.
- Tablet surfaces that are brittle, that soften in the presence of heat, or that are affected by the coating composition tend to become rough in the early phase of the coating process and are unacceptable for film coating.
- The ideal tablet shape for coating is a, sphere, which allows the tablets to roll freely in a coating pan, with minimum tablet to tablet contact. The more convex the surface is, the fewer difficulties will be encountered with tablets agglomeration.
- The surface properties of the tablet depend on the chemical nature of the ingredients utilized in the formulation.

2. COATING PROCESS

Three types of equipments

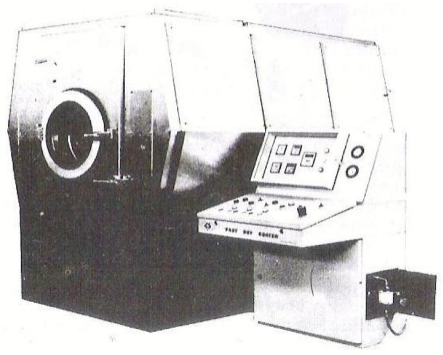
A. Conventional Pan Systems
   a) Pellegrini system
   b) Immersion-sword system
   c) Immersion –tube system
B. Perforated Pans Systems
   a) Accela-coata
   b) Hi-coater systems
   c) Driacoater
   d) Glatt coater
C. Fluid Bed Systems

A. **Conventional pan systems:** The standard coating pan system consists of a circular metal pan mounted somewhat angularly on a stand. The pan is 8-60 inches diameter and is rotated on its horizontal axis by a motor. Heated air is directed into the pan and onto the tablet bed surface, and is exhausted by means of ducts positioned through the front of the pan.



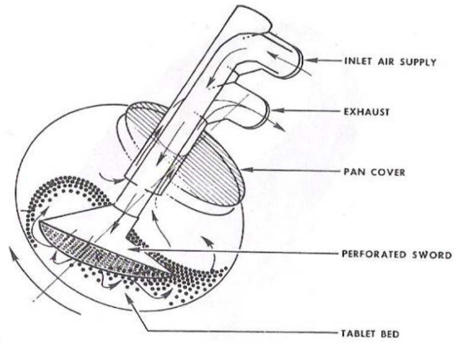
a) Pellegrini pan:

- Has a baffled pan and diffuser for uniform distribution of drying air.
- It is enclosed and automated.



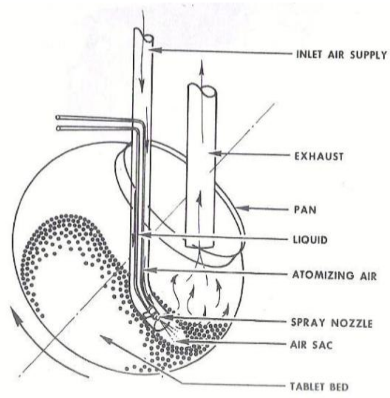
b) Immersion-sword system:

- Drying air is introduced through a perforated metal sword immersed in the tablet bed.
- The drying air flows upward through bed.
- Coating solutions are applied by an atomized spray system directed onto the tablet bed surface.



c) Immersion-tube system:

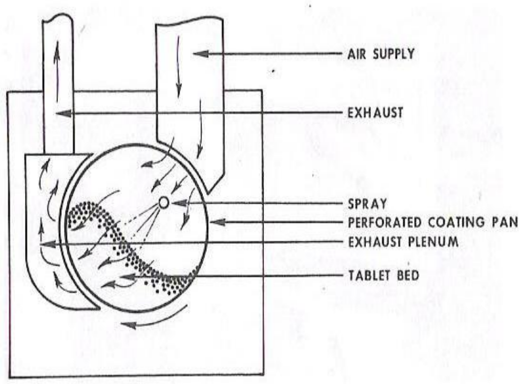
- The tube immersed delivers heated air and
- Coating solution is applied through spray nozzle built in the tip of tube
- The drying air flows upward through the tablet bed and is exhausted by a conventional duct.



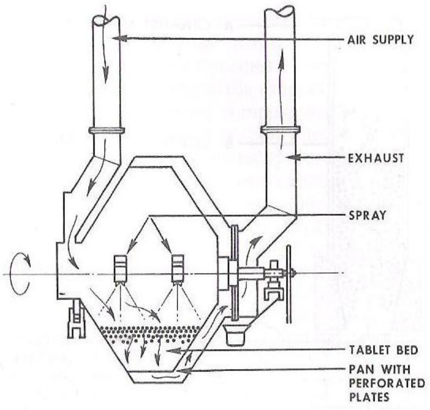
B. Perforated pan system: It consists of a Perforated or partially perforated drum that rotates on its horizontal axis in an enclosed housing.

a) Accela-Coata and Hi-coater system: Drying air is directed in to drum, is passed through bed, and is exhausted through perforations in to drum.

Accela cota system

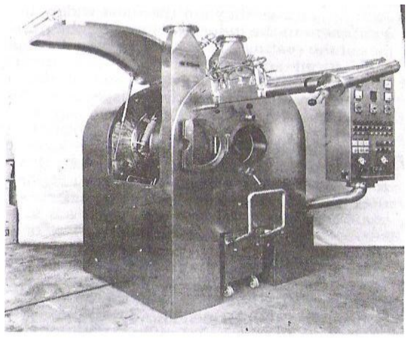


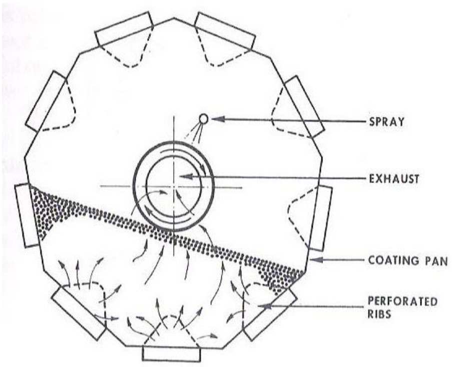
Hi-coater system



b) Driacoater:

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



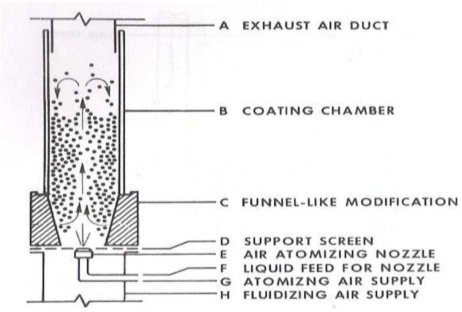


c) Glatt coater :

- Drying air is directed from inside the drum through the tablet bed and out an exhaust duct
- It consists of an optional split-chambered plenum, drying air can be directed in the reverse manner up through the drum perforations for partial fluidization of the tablet bed.
- Several air flow configurations are possible.

C. Fluidized bed (Air suspension system):

- These are highly efficient drying systems
- Fluidization of tablet bed is achieved in a columnar chamber by the upward flow of drying air.
- The airflow 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 through the center of the chamber. They then fall towards the chamber wall and move downward to re-enter the air stream at the bottom of the chamber.
- Coating solutions are continuously applied from a spray nozzle 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.

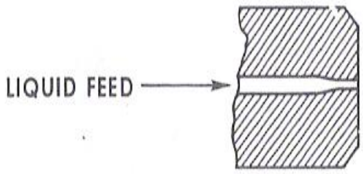


Spray application System

Two basic types of spray system differ in manner in which atomization of liquid is achieved

1. High-pressure, air less system - Liquid pumped at high pressure (250-3000 psig) through small orifice, fine spray.

Degree of atomization depends on Fluid pressure, Orifice size,Viscosity of liquid

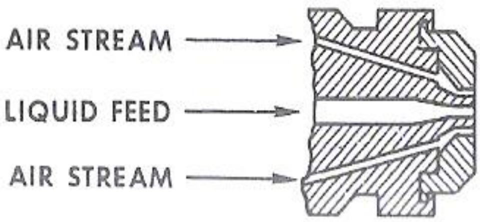


2. Low-pressure, Air atomized - Liquid pumped through large orifice at low pressure (5-50 psig).

Air contacts liquid stream at tip of atomizer and fine spray is produced.

Controlling variables-Fluid pressure, Fluid cap orifice, Viscosity of liquid, Air pressure, Air cap design

Choice depends on coating solution formula and on the process developed for a particular product.



Parameters

In a continuous coating operation, the coating operation is maintained essentially at equilibrium, where the rate of application of the coating composition equals the rate of evaporation of volatile solvent. Deviation from these results serious coating problems. Mathematical modeling for automated aqueous coating process.

Inlet A (T 1, H 1) +C 1 (S) +pSA 1 →A (T 2, H 2) +C 2 +pSA 2 + Exhaust

Where, A (T, H) = Air capacity, C(S) = Coating Composition, pSA = Tablet surface area, E = Equipment efficiency.

- Air Capacity
- Coating Composition
- Tablet Surface Area
- Equipment efficiency

Air Capacity: It represents the quantity of water or solvent that can be removed during coating process. This depends on:

- Quantity of air flow through tablet bed,
- Temperature of air,
- Water content of inlet air.

Coating Composition: The coating contains the ingredients that are to be applied on the tablet surface and the solvents, which acts as a carrier for the ingredients.

- The inlet air provides the heat to evaporate the water/ solvent.
- The exhaust air becomes cooler and contains more water, owing to the evaporation of the solvent from the coating composition.
- If the tablet surfaces are permeable to the applied coating solution, it can cause coating difficulties.
- Most of the coating composition is solvent, so rapid removal is necessary to prevent adverse effects on tablet integrity.
- Thin, rapidly drying formulations dry quickly on the tablet surface, allowing constant application by efficient atomization of coating solution

Tablet surface area:

- The size of the tablet and presence of debossed features affects the coating conditions.

- The total surface area per unit weight decreases significantly from smaller to larger tablets.
- For same thickness of film, smaller tablets requires more coating composition as compared with larger tablets
- Size of atomized coating droplets must be smaller and better controlled as the features to be coated become smaller.

Equipment efficiency, E:

$$\text{Coating Efficiency, E} = \frac{\text{Net increase in coated tablet weight}}{\text{Non volatile coating weight applied to tablets}}$$

- Ideally, 90 to 95% of the applied film coating should be on the tablet surface.
- Coating efficiency for conventional sugar coating is much less and 60% would be acceptable.
- This significant difference in coating efficiency between sugar coating and film coating relates to the quantity of coating material that accumulates on the pan walls.
- With an efficient film coating process, little coating material accumulates on the wall, but with sugar coating, the pan walls become thickly covered with coating.
- A common cause of low film coating efficiency is that the application rate is too slow for the coating conditions (large tablet surface area, high airflow, and high temperature).
- This results in drying part of the coating composition before it reaches the tablet surfaces, so that it is exhausted as dust.

Facility and Ancillary Equipment

- The facility required for any coating operation should be designed to meet the requirements of cGMP.
- Adequate space is needed for the coating equipment, solution preparation and in-process storage.
- The safety requirements depending on nature of solvent, where explosive or toxic concentrations of organic solvents could occur, during either solution preparation or the coating operation, electrical explosion-proofing, specialized ventilation are required.
- Exhaust air treatment may be done to recover solvent or to prevent entry in to atmosphere.
- Federal EPA defines limits of organic solvents and particulate allowed in atmosphere.
- Other Equipments needed to support the coating operation are Tanks, filters, mixers, mills, jacketed tanks, portable pressure tanks or pumping systems.

Automation

- It involves the development of a process in which all the important variables are predetermined.
- Through a series of sensors and regulating devices for temperature, airflow, spray rate and pan speed, a feed back control of the process is maintained.

TYPES OF COATING PROCESSES

Three main types of coatings used in the pharmaceutical industry are

- Sugar coating
- Compression coating
- Film coating

1. SUGAR COATING:

- It involves successive application of sucrose based coating formulations to tablet core, in suitable coating equipment.
- Water evaporates from the syrup leaving a thick sugar layer around each tablet.
- Sugar coats are often shiny and highly colored.
- Typically, tablets are sugar coated by panning technique, using traditional rotating

sugar-coating pan with a supply of drying air (thermostatically controlled).

- The pan is automatically rotated, allowing tablets to tumble over each other while making contact with the coating solutions which are gently poured or sprayed, portion wise onto the tablets with warm air blown to hasten drying. Each coat is applied only after the previous coat is dried.

STEPS IN SUGAR COATING:

- Seal coating
- Sub coating
- Syrup coating/Smoothing
- Color coating
- Polishing

1. Sealing (Waterproofing)

- This involved the application of one or more coats of a water proofing substance in the form of alcoholic spray, such as pharmaceutical Shellac (traditionally) or synthetic polymers, such as CAP.
- (WHY Sealing?)
- Sugar-coatings are aqueous formulations which allow water to penetrate directly into the tablet core and thus potentially affecting product stability and possibly causing premature tablet disintegration.

2. Subcoating

- Large quantities of sugar-coatings are usually applied to the tablet core ,typically increasing the tablet weight by 50- 100%

WHY?

- In order to round off the tablet edge. Much of this material build-up occurs during this stage and is achieved by adding a bulking agent such as Calcium carbonate, to the sucrose solution.
- Antiadherents e.g. Talc may be added after partial drying to prevent sticking of the tablets together.

3. Smoothing / syrup coating

- To cover and fill in the imperfections in tablet surface caused by subcoating.
- To impart desired color
- The first syrup coat contains some suspended powders and are called “grossing syrups”
- Dilute colorants can be added to provide tinted base that facilitates uniform coating in later steps.
- Syrup solutions containing the dye are applied until final size and color are achieved.

4. Finishing

- Final syrup coating step
- Few clear coats of syrup may be applied.

5. Polishing

- Desired luster is obtained in this final step
- Clean standard coating pan, canvas-lined coating pans
- Application of powdered wax or warm solution of waxes in suitable volatile solvent

Formulations of coating solution: The constituents of coating solutions used for sugar coating are given below:

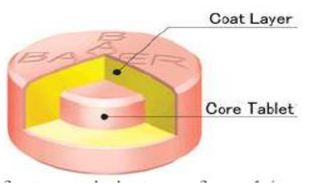
Seal coating	Sub coating	Syrup coating	Polishing soln.
Zein/Shellac	Gelatin	Colorant	Carnauba wax
Oleic acid	Acacia	Sub coating powder	(yellow)
Propylene glycol	Sugar cane powder	Cal. Carbonate	Bees wax
PEG 4000	Corn syrup	Cane sugar powder	(white)
Methylene chloride	Syrup	Corn starch	Paraffin wax
Alcohol	Distilled water	Syrup	Naphtha
		Distilled water	

Enteric coating polymers: Cellulose acetate phthalate, Acrylate polymers, Hydroxypropyl methyl cellulose phthalate, Polyvinyl acetate phthalate

Solvents used for coating: Ethanol, Methanol, Isopropanol, Chloroform, Acetone, Methylene chloride, Methylene ethyl ketone

2. COMPRESSION COATING

- Although less popular, it gained increased interest in recent years for creating modified-released products involves the compaction of granular materials around preformed tablet core using specially designed tableting equipment.
- Compression coating is a dry process.
- After tablet / core manufacture, it is transferred (centrally positioned) to a slightly larger die that is partially filled with a coating powder. More coating powder is filled on the top of the core and compressed again resulting in tablet with in tablet.
- Mechanically, it a complex process, as a tablet may be tilted when transferred to a secondary die cavity.



Need for compression coating

- Traditionally, to separate incompatible material (one in core and other in coat). There is an interface between two layers and thus compromise product stability. It is possible to apply an inert placebo coating layer first, to separate core from the final coat.
- Used to create modified release product.

3. Film Coating

Film coating and sugar coating shares the same equipments and process parameters.

Two methods,

1) Pan-Pour method:
   - Same as that of pan-pour sugar coating
   - Method is relatively slow and relies heavily on skill and technique of operator
   - Aqueous based film coating is not suitable due to localized over-wetting.
2) Pan-Spray method:
   - Use of automated spraying system

Types of film coating

- Immediate release
- Modified release

Film coating formulation (Composition of the coating liquid)

1. POLYMER / FILM FORMER: A film former capable of producing smooth thin films reproducible under the prescribed coating conditions.

Classified as

1. Non enteric materials

E.g. HPMC, MHEC, EC, HPC, Povidone, SCMC, PEG, Acrylate Polymers

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2. Enteric materials

E.g. CAP, Acrylate Polymers, HPMCP, PVAP.

POLYMERS FOR FILM COATING

Immediate release coating polymers	Modified release coating polymers	
	Extended release	**Enteric coating**
1.Cellulose derivatives: The mostly widely used of cellulosic polymers is **HPMC** **(WHY?)** - It is readily soluble in aqueous media - Forms film with good mechanical properties (strength, flexibility and adhesion to the tablet core) - Easy application of the coat Other examples are MC & HPC **2. Vinyl derivatives:** PVP, it has a limited use in film coating because of its inherent tackiness. A copolymer of PVP and vinyl acetate forms better films.	They are dissolved in Organic solvent or dispersed in aqueous medium (why for enteric coating?) **Cellulosic derivatives:** Highly substituted cellulosic ether, thus rendering the polymer water-insoluble. E.g. Ethyl cellulose	**1.Methacrylic acid copolymers:** The presence of carboxylic acid groups renders this class to be insoluble in water at low PH (stomach) but gradually becomes soluble as the PH rises. E.g. Ethyl cellulose towards neutrality (upperpart of the small intestine). **2. Phthalate esters:** e.g. cellulose acetate phthalate

ENTERIC MATERIALS:

- Reasons for enteric coating
- Protect acid labile drugs from gastric fluid e.g. enzymes
- Prevent gastric distress or nausea due to irritation from drug, e.g. Sodium Salicylate
- To deliver drugs for local action in intestines, e.g. Intestinal antiseptic (Kanamycin)
- For drugs optimally absorbed in small intestine
- Provide delayed release component for repeat-action tablets

Material should have following properties:

- Resistance to gastric fluids
- Ready susceptibility or permeability to intestinal fluids
- Stability with coating composition and drug substrate
- Stability alone and in coating solution
- Formation of continuous film
- Nontoxic, Low cost
- Ease of application without special equipments
- Ability to be printed or to allow film to be applied to debossed tablets

2. PLASTICIZER:

These afford flexibility and elasticity to the coat and thus provide durability.

They are of two types:

- **Internal plasticizers**: Chemical modification of the polymer that alters the physical properties.
  - Degree of substitution
  - Type of substitution
  - Chain length.
- **External plasticizers** : They are non-volatile or the other polymer, which when include with primary polymeric film former, changes the
  - Flexibility

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- Tensile strength, or
- Adhesion properties of the resulting film.

Concentration of Plasticizer Expressed as the amount of polymer being plasticized.

Recommended Level of Plasticizer: 1 to 50% by weight of the film former.

EXAMPLES

- Castor oil; propylene glycol of 200 and 400 series; and surfactants eg; Tweens; Spans; and organic acid esters.
- Water- soluble plasticizer: PEG, propylene glycol.
- Organic- soluble plasticizer : castor-oil and Spans

3. COLORANTS

- Colorants may be soluble in the solvent system or suspended as insoluble powders.
- Used to provide distinctive color and elegance to a dosage form.
- To achieve proper distribution of suspended colorants in the coating solutions requires the use of fine-powdered colorants (< 10 microns).
- Most of colorants are synthetic DYES or LAKES OF DYES approved by the FD&C and D&C.

LAKES: derived from dyes by precipitating with carriers. Eg; alumina or talc.

- Lakes contains 10 to 30 % of the pure dye content.
- For very light shade, concentration: less than 0.01 %.
- For dark shade, concentration : more than 2.0 %
- Examples
  - Inorganic materials: iron oxides
  - Natural coloring materials: Anthocyanins, caramel, carotenoids, chlorophyll, indigo, flavones, turmeric, and carminic acid.

4. OPAQUANT-EXTENDERS

- These are very fine inorganic powders used in the coating solution formulation to provide more pastel colors and increase film coverage.
- Opaquant provides a white coating or mask the color of the tablet core, and thus the less amount of the colorants are required.
- Examples: Silicates (talc, aluminium silicate); Carbonates (magnesium carbonate); Sulfates (calcium sulfate); Oxides (Mg oxides)

5. SOLVENTS

Volatile organic solvents may be used to allow good spreadability of the coat components over the tablet and allowing rapid evaporation, but they are expensive and show environmental hazards. Aqueous vehicles are safer, but they show slower evaporation and may affect drug stability.

Ideal characters of coating material

- Solubility in the coating solution.
- Capacity to produce elegant looking product.
- Stability in presence of water, heat, moisture, air, and substrate being coated and no change in properties with aging.
- Essentially no odor or taste.
- Compatibility with common coating solution additives.
- Nontoxic and ease of application.
- Resistance to cracking and should act as barrier.
- No bridging or filling of the debossed tablet surfaces by the film former.
- Ease of printing procedure on high-speed equipment.
- Low cost & Ease of application without specialized equipment.

Advances in tablet coating

Specialized coating techniques include

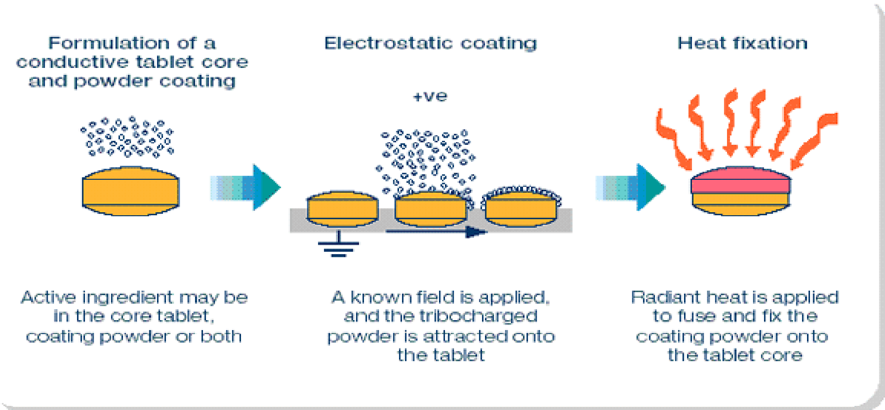
1. Dip coating
2. Electrostatic coating
3. Laminated coating
4. Vacuum film coating
5. Dry coating

1. DIP COATING:

- In this, cores to be coated are a held in a suitable device eg: baskets
- Dipped into coating solution and then dried taking care to prevent adherence to one another.
- For obtaining more perfect or heavier coats the dipping and drying steps may be repeated several times one after another.
- Several dipping arrangements are obtainable, amongst them the sophisticated devices comprise tiny suction tubes, which hold the individual tablets apart until drying is accomplished.
- Before proceeding to coat additional tablets or begin recoating cycles.

2. ELECTROSTATIC-COATING

- Electrostatic coating is an efficient method of applying coating to conductive substances.
- In this, an ionic charge is imparted to the core and an opposite charge to the coating material. This technology ensures thin, continuous and electronically perfected film to the surface.



3. LAMINATED-COATING

- Laminated coating provides multiple layers for incorporation of medicament.
- For example
- Repeat-action tablet, here a portion of the drug is kept in outer lamella or coating.
- Enteric tablet, here one drug could be made available for gastric absorption while another for release in intestine.
- Buccal-swallow tablet, this could first be administered sublingually, and upon a signal, such as release of flavour from the inner core, the same may be swallowed as a normal peroral tablet.

4. VACCUM FILM-COATING

- This employs a specially designed baffled pan, which is water-jacketed and could be sealed to achieve vacuum.
- Tablets are placed in the sealed pan, the vacuum is applied and the coating material is introduced through airless hydraulic spray system. Since the pan is completely sealed.

- Organic solvents could be effectively used with minimal environmental or safety concern.

5. DRYCOATING

- Dry coating avoids the use of water or, at least, allows it to be reduced to very small amounts with respect to the coating material, thus overcoming the need for time- and energy-consuming drying phases, as well as possible drug stability issues.
- In this technology, powdered coating materials are directly coated onto solid dosage forms without using any solvent, and then heated and cured to form a coat.

Problems encountered in Coating

1. Sticking & Picking
2. Roughness
3. Orange peel effect
4. Bridging
5. Filling
6. Blistering
7. Hazing/Dull film
8. Color variation
9. Cracking

1. STICKING & PICKING

- Over wetting or excessive film thickness causes tablets to stick each other or to the coating pan.
- On drying at the point of contact, a piece of film may remain adhere to pan or tablet, giving "picked" appearances to the tablet surface. Resulting in a small exposed area of the core.

Remedies

- Reduction in liquid application rate.
- Increase in drying air temperature and air volume.

2. ROUGHNESS

- A rough or gritty surface observed when the coating is applied by spray. Some of the droplets may dry too rapidly before reaching the tablet bed and spray- dried particles deposits on tablet surface instead of finely divided droplets of coating solution. Surface roughness also increases with pigment concentration and polymer concentration in the coating solution.

Remedies

- Moving the nozzle closer to the tablet bed or
- Reducing the degree of atomization can decrease the roughness due to spray drying.

3. ORANGE PEEL EFFECT

- Inadequate spreading of coating solution before drying causes a bumpy or Orange –peel effects on the coating. This Indicates that spreading is impeded by too rapid rate of drying or by high solution viscosity.

Remedies

- Thinning of coating solution with additional solvents may correct this problem.
- Adjustment of speed of coating pan

4. BRIDGING

- During drying film may shrink and pull away from the sharp corners of bisect, resulting in a "Bridging" of surface depression. This defect can be so severe that the monogram or bisect is completely obscured.

Remedies

- Increase in plasticizer contents or
- Change in plasticizer

5. FILLING

- Applying too much solution, resulting in a thick film that fills and narrows the monogram or bisects. In addition, if solution applied too fast, over wetting may cause the liquid to quickly fill and be retained in the monogram.

Remedies

- Judicious monitoring of the fluid application rate.
- Thorough mixing of tablets in the pan prevent filling.

6. BLISTERING

- Evaporation of solvents from the core in the oven. And effect of high temperature on the strength, elasticity and adhesion of the film may results in blistering.

Remedies

- Controlled milder drying conditions.

7. HAZING/DULL FILM

- Also called as bloom.
- It can occur when too high a processing temperature is used for a particular formulation. Dulling is particularly evident when cellulosic polymers are applied out of aqueous media at high processing temperature. Also occur if the coated tablets are exposed to high humidity conditions and partial solvation of film results.

8. COLOR VARIATION

- Improper mixing, uneven spray pattern and insufficient coating may results in color variation. The migration of soluble dyes, plasticizer and other additives give the coating a mottled or spotted appearance.

Remedies

- Use of lake dyes eliminates dye migration.
- Reformulation with different plasticizer and additives is the best way to solve film instability.

9. CRACKING

- Cracking occurs if internal stresses in the film exceed the tensile strength of the film. The tensile strength of the film can be increased by using higher molecular weight polymers or polymer blends.

Remedies

- Adjusting the plasticizer type and concentration can minimize internal stresses.
- Adjusting the pigment types and concentration can minimize internal stresses.

CONCLUSION

In recent decades, coating of pharmaceutical dosage forms has been subject of remarkable developmental efforts aiming to ensure and enhance end product quality. Improvements regarding particle movement, heat and energy transfer, film distribution, drying efficiency and continuous processing have contributed to significantly develop this technology. In future there is enormous developments has to be done in the area of tablet coating

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***Corresponding Author:**
B.Venkateswara Reddy
Department of Pharmaceutics, St.Paul's College of Pharmacy,
Turakayamjal village, Hayath Nagar Mandal,
Ranga Reddy Dist-501510, A.P.