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RECENT ADVADVANCEMENT IN TABLET COATING – A REVEW

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ABSTRACT :

Tablet coating is an important step in the preparation of controlled and delayed release tablets. Tablet coating has many advantages such as masking the odor, taste and color of the drug, providing physical protection and resistance to the drug, and protecting the drug from the gastric environment. Tablets are usually coated in a horizontal rotating pan where the process is directly poured or sprayed. The amount of coating on the tablet surface is important for the performance of the oral form. Recent trends in tablet coatings aim to overcome the disadvantages of solvent based coatings. This review includes coating techniques, related materials, evaluation of coated tablets and specific coating techniques. A good tablet coating should not exceed the small overlap and differential tablet coating limit. Tablet layer can be simulated on the computer with the help of discrete element method. Simulation data helps to accurately measure the time and direction of each tablet exposed to spray coating by providing the position, speed and direction of each tablet in the coating machine.

Keywords: Tablet Coating, Enteric coating Tablet, Sugar coating, Gelatine Coating, Film Coating.

1. Introduction :

Tablet could be a strong measurement frame, comprising a blend of dynamic substances and excipients, commonly in powder shape. In order to achieve precise advantages, coating may involve encasing the surface of a dosage form with an outer layer of coating cloth. Coating may be executed to a wide run of verbal strong dose shape, at the side capsules, multi particulates and sedate precious stones. Whereas coating composition is carried out to a clump of capsules in a coating container, the tablet surfaces develop to be ensured with a tasteless polymeric film. Sometime recently the tablet floor dries, the carried-out coating alterations from a sticky fluid to tasteless semisolid and afterward to a non-sticky dry surface dish. Numerous steady pharmaceutical dose shapes are created with coatings, both on the outside surface of the tablet dose, or on substances apportioned interior the gelatin tablets. The tablet ought to dispatch the medicament relentlessly and the sedate ought to be had for absorption. The coating strategy can be especially defined to alter how fast the tablet breaks down and in which the tablets are to be retained into the body after ingestion. The total coating framework is conducted in a chain of routinely worked acorn-formed coating dish of stainless-steel, galvanized press or copper. The larger container is used for mechanical generation, while the smaller dish is used for exploratory, formative, and pilot plant activities.

1.1 The requirement of coating

- A substance with an unpleasant aroma or a bitter taste in the mouth is present in the core.
- The coating helps to increase the drug's stability and shield it from the environment.
- A coating will make it easier for the patient to swallow a pill.
- By increasing mechanical strength, coating makes items more resilient to handling errors such abrasion and attrition.
- A coating is applied to increase stability since the core includes a material that is oxidised by the atmosphere and incompatible with light.
- The core is ugly on its own.
- The active ingredient is coloured and readily migrates to discolour clothing, hands, and other surfaces.
- Unlike uncoated pills, coated tablets are packaged using a high-speed packaging equipment.
- Coating speeds up packing and lowers friction.
- Coating, such as enteric coating, osmotic pump, and pulsatile delivery, can also alter the drug release characteristics.

1.2 Principal of tablet coating

Applying a coating composition on a moving bed of tablets while using hot air to promote solvent evaporation is known as tablet coating.

- A solution that hardly affects the release pattern without significantly altering the look.
- An insulation-producing color coating.
- To prevent chemical incompatibilities, add a different medication or formulation to the coating.
- To offer a medication release that is consecutive.

2. Factors af Tablet Coating :

1. Tablet Properties
2. Coating Equipment
3. Coating Properties

2.1 Tablet Properties

- The tablet needs to be chip and abrasion resistant.
- A spherical tablet is the best form for coating.
- The tablet's harness should weigh no more than or equal to 5 kg/cm2.
- The pills ought to be friable.
- The tablets must be resistant to abrasion and chipping in order to withstand the high attrition of tablets hitting one another or the walls of coating equipment.
- Tablets with soft, brittle surfaces when heated are not suitable for film coating.

2.2 Coating Equipment

There are 3 types of equipment's generally used for tablet coating.

1. Perforated coating Pan
2. Fluidized bed coater
3. Conventional coating pan

2.3 Coating Process

The fundamental idea of tablet coating is straightforward. Applying a coating substance on a moving bed of tablets while using heated air to help the solvent evaporate is known as tablet coating. The tablets are moved either vertically air suspension or perpendicularly coating pan to distribute the coating.

3. Methods of Tablet Coating :

The study of a medical ingredient's physical and chemical properties, both alone and in conjunction with excipients, is known as preformulation. By agitating the tablets in a pan, maximal coating techniques spray the coating solutions onto the tablets. A small layer of the solution is created while spraying and sticks to each tablet directly. The usage of rotating coating pans is common in the pharmaceutical sector. The liquid coating gun is delivered into the pan even after the tablets have begun to tumble, and the uncoated tablets are situated within. The coating gun's liquid component is then evaporated by blowing air over the medications' surface as they tumble. To help and separate the medications as personal devices, a fluid bed coater actually works by moving air through a bed of pills at a certain speed. The coating mixture is sprayed on the medications as soon as they have been separated. Typically, the coating process involves the following steps:

a) Loading
b) Preheating
c) Spraying
d) Drying
e) Cooling
f) Unloading

3.1 Traditional methods of tablet coating

Generally, two methos are used for tablet coating

A. Sugar Coating
B. Film Coating

A. Sugar coating-

In sugar coating methods following steps involved

a. Seal Coating also knows as Waterproofing

This required applying one or more applications of a water-proofing chemical or substance in the form of an alcoholic spray, such as synthetic polymers like CAP or medicinal Shellac. Aqueous formulations known as sugar coatings let water to enter the tablet core directly, thereby compromising product stability and accelerating tablet disintegration.

b. Sub Coating

The tablet core typically receives large amounts of sugar coatings, which add 50–100% to the tablet's weight.

c. Smooth Coating

To hide the surface flaws of tablets brought on by sub coating to add the desired color. Some suspended powders, referred to as "grossing syrups," are present in the initial syrup coat. Following that, diluted colorants can be added to create a colored base that will help with subsequent procedures involving uniform coating. After that, dye-containing syrup solutions are added until the desired size and color are reached.

B. Film coating-

Sugar coating and film coating use the same tools and follow the same procedures. The techniques are as follows.
Pan-Pour Method and Pan spray Method are used.
Two types of film coating is used
Immediate Release
Modified Release
For the film coating method used various polymers are HPMC, MHEC, HPC, Peg, CAP, PAVP etc

4. Recent Advancement in Tablet Coating :

Recent developments in tablet coating technologies have improved drug delivery, stability, and patient compliance significantly. Nanotechnology has been employed in coating the tablets so as to deliver APIs with optimized release profiles. This nanocoating enables the encapsulation of polymer, antioxidant and flavoring agent so as to have enhanced control of release rates in addition to such benefits as having an antimicrobial character. There is a trend toward sustainable and aqueous-based coating solutions. These coatings have less environmental impact and avoid organic solvents, making them safer for both manufacturing and patients.

4.1 Compression Coating

These tablets feature components such as an outer cover and an interior core. The core is arranged on a single turret and is a tiny porous tablet. A larger die hollow space in each other turret is used to prepare the final tablet. The coat cloth is first compressed to half of the space, and then the center tablet is robotically moved. The final space is then filled with coat fabric, and finally compression force is applied. The coat frequently dissolves easily after ingesting since it is water soluble.

With the tooling confirmed to create a cup-shaped tablet, a precisely weighed amount of powder combination was placed into the die and squeezed using a Carver Press (Wabash, IN) at a recognized force. A known amount of a model drug and a drug-containing mixture were placed into the cup and gently tamped with the punch over an extended period of time after the cup was left in the die.

4.2 Electrostatic Coating

In electrostatic powder coating, powder is sprayed in a region with a high concentration of loose ions and a strong electric field. when was previously mentioned, the particles are charged when they pass through this area. Pauthenier's equation is used to control the charging process of powder particles inside the electric region of corona discharge. Field power, powder particle size and shape, and the amount of time the particle is in the charge region all have a significant impact on charging.

4.3 Electrostatic Dy Coating

With the use of electrostatic dry powder coating in a pan coater device, an electrostatic dry powder coating technique for tablets was initially developed. Capsules with a smooth surface, proper coating uniformity, and a release profile that matches the tablet cores are produced using the optimized dry powder coating process. For pharmaceutical items, this innovative electrostatic dry powder coating method offers an alternative to aqueous or solvent-based coating methods.

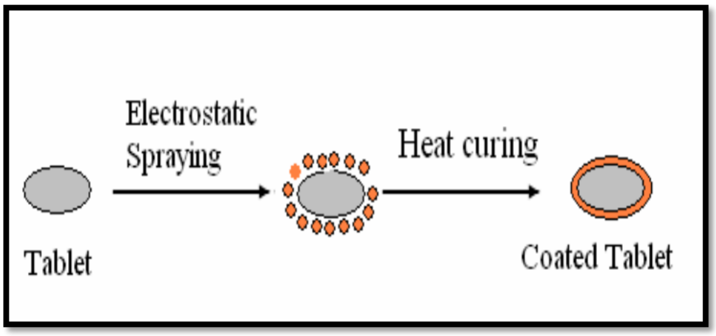

Figure-1 Diagram of Electrostatic dry coating

4.4 Magnetically Assisted Impaction Coating (MAIC)

Compression coating, plasticizer dry coating, heat dry coating, and electrostatic dry coating are some of the dry coating techniques that have been developed. In order to accomplish coating, these techniques often permit the application of severe shearing stresses, high impaction pressures, or exposure to higher temperatures. The guest particles may layer or even embed themselves on the surface of the host particles as a result of the powerful mechanical forces and the heat that is produced.

The processing tank encircled by a number of electromagnets that are connected to the alternating current host and guest materials, as well as the measured mass of the magnetic particles, make up the apparatus for MAIC. Barium ferrite is used to make the magnetic particles, which are then coated with polyurethane to keep the coated particles clean. Similar to a fluidized bed system, the magnetic particles inside the vessel are agitated and move wildly when there is a magnetic field present.

The host and guest particles then get energy from these agitated magnetic particles, which leads to collisions and enables coating via impaction or peening of the visitor particles onto the host particles. According to research on the motion of magnetic particles, the main motion caused by the magnetic field is the spinning of the particles, which encourages the guest particles to de-agglomerate and spread and shear onto the host particles' surface.

4.5 Supercell TM Coating

The typical method of coating tablets frequently results in a non-uniform outcome. Due to the fact that the tablets are placed in big rotating pans and allowed to dry by hot air, the edges of the tablets may get grounded off, and the coating material may fill in the intagliation, resulting in uneven coating on the tablet faces and edges/corners. Friable tablets or tablets that are flat or very oblong can also be coated using SupercellTM Coating Technology. Extremely hygroscopic tablets can be coated thanks to this process's quick drying time. API may be layered into tablets with a high enough deposition accuracy, and consistent layers of modified release coatings or flavor masking can be placed one after the other in a single continuous batch.

Super cell coating technique has the following special qualities

1. 1.Short Processing time
2. Flexible modular design
3. Continuous coating
4. No scale-up to parameters
5. Multi-layer coating
6. Enhancing technology

4.6 Syloid FP Silicas used in Film coating

Film coatings have recently demonstrated promising outcomes in facilitating the oral administration of peptide therapies. Because of their distinct shape, Syloid FP silicas have been utilized as excipients in several medicinal compositions. Porosity, particle size, increased surface area, and combined adsorption capability enable them to offer many advantages at once, which can speed up production and enhance the final dosage form's effectiveness. Acrylic or vinyl/cellulose polymers can be combined with Syloid FP silica to create polymeric coating solutions. When added to film coating at typical concentrations, Syloid 244FP silica offers the following benefits:

1. Improvement of suspension properties
2. Improvement spray properties
3. Elimination of need of talc
4. Prevention of valve clogging
5. Minimal settling in spray lines
6. Smoothen tablet surface
7. Reduction of adhesion

4.7 Fluid Bed coating

Particulate matter is coated, granulated, agglomerated, and dried during fluid bed processing. A bed of solid particles with a stream of gas or air flowing upward through the particles quickly enough to cause motion is called a fluidized bed. The possibility for better mixing arises from the ability to propagate wave motion. The fluid bed can be used to dry the wet product, agglomerate particles, enhance flow characteristics, and coat particles for controlled release or flavor masking, among other uses. Top spray, bottom spray, and tangential spray are the three patterns of fluid-bed processes that may be distinguished by the placement of the spray nozzle. The bottom-spray (Wurster) procedure is the most widely used fluid-bed coating method in the pharmaceutical sector.

Through the plenum chamber, air enters and is dispersed uniformly to facilitate heat transmission and fluidization. The air stream fluidizes the pellets, which then decelerate in the expansion chamber and fall outside the wurster column as they ascend. The particles that are returned go downhill until they are drawn back up into the loop.

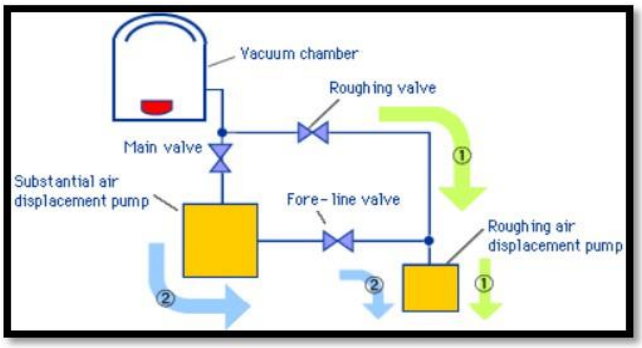

Figure 2 Vacuum Film coating

4.8 Top Spry coating Technique

The top spray fluid mattress technology is widely used for granulation, but its use for coating is limited. The best technique, with the lowest capital cost and the highest capability, is top spraying. In addition to many other things, it might be used to manipulate taste. The food, feed, and chemical sectors frequently employ this alternate way as the film's feature primarily improves overall situational management.

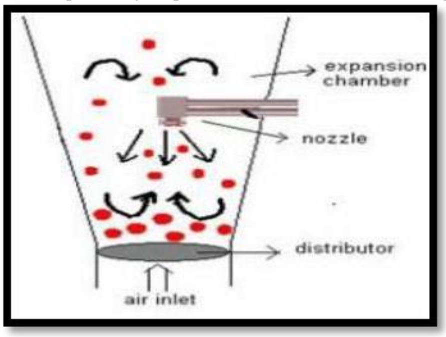

Figure 3 Top Spray coating Technique

4.9 Bottom Spry coating Technique

The bottom-spray approach is the most widely used fluid-bed coating technology in the pharmaceutical sector. An air distribution plate and a partition that facilitates the fluidization of trash particles across the partition are the specific functions of bottom-spraying. The nozzle is aimed toward the coating zone and is situated at the bottom of the product box.

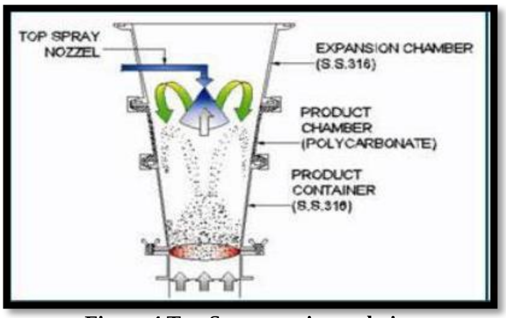

Figure 4 Top Spray coating technique

4.9 Defects and Solutions of tablet coating

Picking and Sticking

This occurs when a portion of the tablet gets separated from the core by the coating. Weak or soft granules, under-drying, or excessive wetting of the tablets are the causes.

Bridging

This happens when the coating covers the letters or the tablet's logo. It is typically brought on by too much solution application, shoddy tablet embossment design, excessive coating viscosity, a high concentration of particles in the solution, or incorrect atomization pressure.

Erosion

Soft tablets, an excessively damp tablet surface, or a weak tablet surface are the causes of this.

Blisterling

Blistering may result from the solvent evaporating from the coated tablets too quickly and from the high temperature's impact on the film's flexibility and strength. In this instance, milder conditions are needed.

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Twining

This is a typical problem with capsule-shaped tablets and refers to two tablets that adhere to one another during coating. This issue may be resolved by adjusting the spray rate and pan speed.

Evaluation of Tablet

Examining the film and the interactions between the film and tablet is necessary to determine the tablet coat's quality. The test procedures listed below can be used.

1. The force required to remove the film from the tablet surface is measured using an adhesion test using tensile strength testers.
2. A tablet hardness tester should be used to measure the coated tablets' dimetric crushing strength.
3. It's also important to research how quickly coated pills dissolve and disintegrate.
4. To confirm if variations in temperature and humidity will cause film flaws, stability tests can be performed on coated tablets.
5. Measurements of tablet weight growth and exposure to high humidity offer relative information on the level of protection the film offers.

6. Conclusion :

The coating of pharmaceutical dosage bureaucracy has been the focus of excellent research efforts in recent decades with the goal of ensuring and improving the quality of tablet dosage form. The most significant risks associated with solvent-based coatings are avoided by electrostatic dry coating and magnetically assisted impaction coating. Techniques yield a consistent coating, although the most straightforward ones require specialized equipment. A certain kind of powder coating composition is required for electrostatic dry coating. Electrostatic dry coating makes it possible to print on tablets with medicinal dose shapes and cover them with distinct colors on either aspect. Studies on the fitness and protection elements of such technologies will ensure their commercialization in the pharmaceutical industry, just as the protection factors of those coatings in humans have not yet been revealed. Improvements in film distribution, drying performance, warmness and power switch, particle motion, and continuous processing have all helped to advance this technology.

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