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Review Article

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An Updated Review on Tablet Coating

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ABSTRACT

Tablet coating is an essential technique of spraying a thin polymer-based film to the outer area of Tablets, which consist of active ingredients in it. Primary aim of coating is give protection from gastric fluid and physical stress. Different techniques of tablet coating such as sugar coating, film coating, and enteric coating are used most commonly. There is a continuous effort to overcome the drawbacks of older coating techniques. Coating material is directly applied on the surface of the tablet without use of any solvent. According to ICH guidelines organic solvents are least preferred in Pharmaceutical formulation to consider product safety profile. Various solvent like superficial fluid coating and newer techniques like magnetically assisted impaction coating, compression coating, hot melt coating, are now also available. This review is focused on the preliminary coating process, equipment involved and latest development on Tablet coating.

Keywords: Tablet coating; Chemical protection; Film coating; Enteric coating

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INTRODUCTION

Coating is a technique by which, Tablet is covered by a material in its outer surface, in order to get specific benefits like protection of dosage form and controlled drug release from it. It can be applied in different types of oral solid dosage forms, including tablet, capsules etc. When coating material is applied to a batch of tablets in a coating pan, the tablet surface becomes covered with an extra surface [1].

The coating technique depends on the following parameters such as the spray pattern, size of droplets, and nozzle spacing etc. These are effectively controlled to get uniform coating layer.

Significance of Tablet coating:

The significance of tablet coating is as follows:

1. To hide unpleasant odor and taste of the tablet.
2. Protection of the drug to improve stability.
3. Overall protection of the drug.

4. To improve the stability.

5. To protect an acid labile drug in the acidic medium.

6. To increase the packaging rate and reduces friction between the tablets when the tablets are packed on high speed packaging machine.

7. Drug release pattern can be altered.

8. Mechanical strength of Tablets get increased [2-4].

Brief History of Tablet Coating

Coating process was started first in the ninth century. A variety of material was used to coat pill, such as talc, gelatin, and sugar. The first sugar coated pill produced in the United States came out of Philadelphia in 1856. Coating resistant to enteric or gastric fluid was developed in the 1880. Film coated tablet was marketed in the year 1954 for the first time. Coating solution was distributed through the bed of tablets through rotating pan.

The major drawback of this technology was that, drying time of tablets is long.

Instrument and equipment used in coating: For the coating process here are three types of following equipment are described below.

Conventional/standard coating pan systems: The conventional coating pan system contains a spherical metal pan fitted angularly on a stand coating pan has 20-152 cm in diameter. A motor rotates it in horizontal axis; heated air is suppressed into the pan and onto the tablet bed surface, and is exhausted ducts positioned through the front of the pan. Coating solution is mixed with the tablets by spraying the material on to the rotating tablet bed.

Use of spraying system: It produces more even and faster distribution of the coating solution.

Application of the solution is continuous in film coating.

Pellegrini pan: It is operated automatically and enclosed properly. Baffled pan: Diffuser (distributes drying air over the tablet bed surface evenly).

Immersion-sword system: Perforated metal sword immersed in the bed of Tablet. Hot air is passed through perforated sword, in upward direction inside the Tablet bed.

Immersion-tube system: Tube inserted in the Tablet bed, delivers the heated air. Coating solution along with the heated air is spread through the immersed tube [5].

Perforated pan system: Drum used for coating is perforated. Perforated coating system is highly efficient for large number of Tablets.

Traditional coating techniques: Three methods of traditional tablet coating techniques are described below.

Sugar coating: It is efficiently done by the pan coating technique. It is very popular method for masking unpleasant test or odor. The various stapes of this process are discussed below [1].

Sieving: Tablets are shaken in a proper sieve. Broken pieces of tablets are removed before coating by this way.

Sealing: A thin layer of water proof materials is deposited on the tablet surface.

Sub coating: In sub coating repeated coating of Sugar or gelatin, acacia etc., are sprayed to round it off.

Syrup coating: Sugar layer coats and color to the tablets. Coloring materials are also added to the syrup with it.

Finishing: Three to four layer of syrup coating are applied rapidly without powder. After each coating cold air is blown for drying each layer, which gives a smooth layer of had coating.

Polishing: Few coats of Beeswax, dissolved in organic solvent are given on it. Canvas cloth is used to rub wax coated Tablets, inside the rotating pan, in a controlled speed which gives a smooth shining later [6].

Film coating: Different types of polymers, such as, Hydroxy Propyl Methyl Cellulose (HPMC), Carbowax, Hydroxy Ethyl Methyl Cellulose (HEMC), Poly Ethylene Glycol (PEG) 400 etc., are used for coating, alone or in a mixture. These are spread in to the Tablets bed after dissolving in a proper organic solvent, in a rotating pan.

Enteric coating: This type of coating is given to protect disintegration of tablets inside the stomach pH. Enteric coating material, such as Cellulose Acetate Phthalate, shellac and its derivatives solution are prepared in a volatile solvent. This solution is then coated over the tablets inside the rotating pan. Solvent layer is then evaporated by passing hot air through Tablet bed.

Coating defects: The list of coating defects of Tablets and their possible causes are listed below [2]:

Picking and sticking: It is caused by over wetting the tablets, by less drying, or by inferior tablet quality.

Capping: Tablet separates in laminar way. This problem arises from the improper compress ion of Tablet. Tablets became brittle, which promote capping process.

Erosion: If the Tablets are over wetted, soft, drying is not sufficient then the problem of erosion takes place.

Peeling and frosting: Peeling means the removal of coating layer form Tablet surface. It indicates the improper locking in the tablet surface. It may happen due to improper coating solution, over wetting, or Tablet containing high moisture content in it.

Chipping: High rotating speed of pan can leads to Chipping of Tablets, a soft tablet core, or lack of good plasticizer increases this problem many fold.

Mottled color: Improper preparation or mixing of coating solution can leads to this problem. If the targeted and actual spray rate differ significantly, cold tablet core or improper drying rate also contribute to mottled color of Tablet.

Orange peel: This refers to a coating texture that resembles the surface of an orange. This occurs due to high spray pressure. Texture of coated Tablet surface became similar like orange surface.

Advanced coating technique: As per the technological advancement, so many new coating techniques were developed to comply the growing need of the pharmaceutical industry. Few of these are discussed below.

Electrostatic coating: Finely grounded particles and polymers are sprayed onto substrate surface without solvent. Solvent based or aqueous coating techniques are now became alternative to conventional coating techniques (Figure 1).

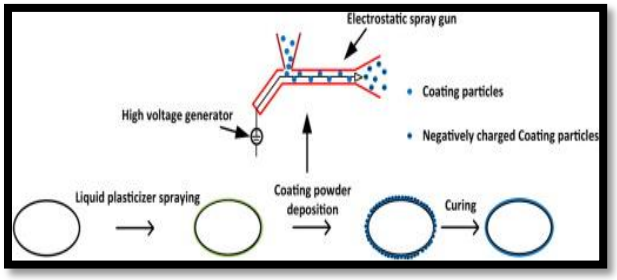

Figure 1. Electrostatic coating

Corona charging: Corona charging is the method used to study the storage and the electric charge transport in dielectric films. Application of corona charging include, drag reduction over a flat surface.

Mechanism of corona charging: This is carried out by the electrical breakdown and then ionization of air is done by applying high voltage in to a pointed outlet of the gun, known as charging pin. Powders flow can be controlled by altering the electrical field. Shape, size and density of powder flow releasing from gun tip can also be changed by this process (Figure 2).

Tribo charging: Tribo charging is a contact electrification process that enables buildup of static electricity due to touching or rubbing of surfaces in specific combinations of two dissimilar materials.

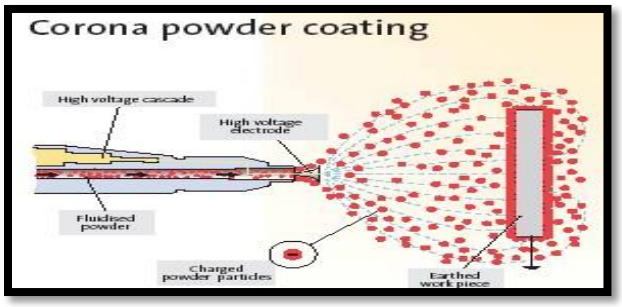

Figure 2. Corona powder coating

Mechanism: the Friction charging coupled with the dielectric characteristics of solid particles are used in tribo charging process, so free ions and electrical field will not be produced between the spray gun the grounded substances.

Magnetically Assisted Impaction Coating (MAIC)

Dry coating techniques like compression coating and electrostatic dry coating produce heat due to heavy mechanical forces. The magnetic particles are stimulated in the presence of magnetic field and move frequently inside the vessel, like a fluidized bed system [7,8]. Mechanism: MAIC process is done in several stages, which are discussed below (Figure 3):

Stage I: Initially magnetic particles are exited.

Stage II: Guest particles or coating materials are de-agglomerated.

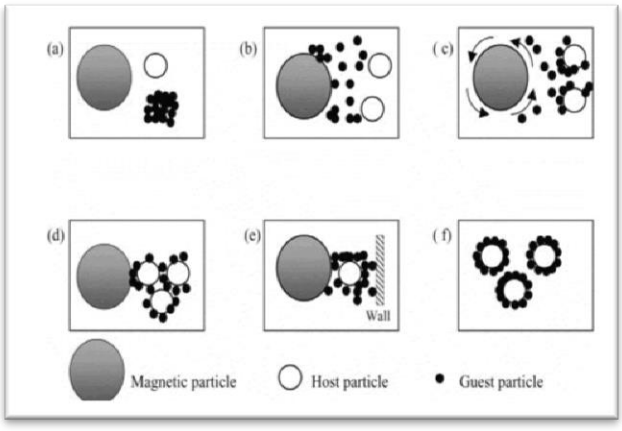

Figure 3. Coating process in the MAIC techniques

Stage III: Magnetic host wall particle interaction.

Stage IV: There is an interaction between particles and coating materials.

Stage V: Coated materials are produced from the above mentioned steps.

Dip coating: Tablets are coated by dipping them in the coating liquid, then diredusing coating pan. This is followed by drying of the coat and finally stabilization of the coat and polishing of the coated tablet.

Compression coating: It is not used regularly, when Tablet core cannot tolerate organic or aqueous solvents, then this type of coating technique are used.

Vacuum film coating: A specially designed baffled pan is used in this technique. The vacuum system is used to remove solvent vapors [4].

Supercell coating technology

In this technique coating materials are deposited on tablets layer in a controlled manner very accurately, hygroscopic or friable tablets are also coated efficiently.

This process is continued slowly to prevent sticking of two or more tablets together, known as "twinning" [9].

Features of super cell coating technology:

- Continuous coating
- Processing time is very short
- Flexible modular design
- No scale up to parameters
- R&D batch size (minimum batch size of 30 grams)
- Enhancing technology
- Multilayer coating
- Difficult to coat shapes
- Friable tablets
- Enabling technology.

Laser assisted cold spray coating: It is generally used to deposit pure metals such as Aluminium, Copper, and Tantalum and composite coatings such as Al-Al_2O_3.

Photo curable coating: Wherein the photo – curable coating composition includes an organic solvent like meth acryloyl monomer, and a diluted monomer are the composition of a optical product. It provides heat resistance, storage stability and high light transmission to prevent discoloration of the optical product [10].

The promoting agents, bubble removing agents, viscosity increasing agents are cured by coating process.

Supercritical coating: Coatings of thin films onto solid particle has been achieved by in-situ simultaneous nucleation and deposition of dissolved material out of supercritical fluid, resultant film formation on the solid particles suspended in the supercritical fluid, and subsequent thermal conditioning of the coating in the particles.

Continuous coating: In present days batch type tablet coaters have been now replaced by advanced continuous tablet coaters where in – process evaluation of the coated tablets is being carried out along with coating of tablet core. The tablet moves the coater by natural migration, no baffles or vanes are used. The tablet uniformity is depends on adjustments to tablet feed rate, pan RPM and residence amount and time all effect.

Continuous coating equipment

Thomas engineering (compu coat): This is used for coating of large volume OTC products like Ibuprofen and nutraceuticals. The pan employs a different kind of arrangement (named as baffle) compared with the vector equipment and the angle of the pan is not adjustable.

O – Hara technology: The most recent introduced coating equipment is O – hara technology. It is divided into two major zones such as four air zones.

The typical start up and shut down process consists of:

Pan is filled with sufficient input to start first spray sequence.

- As the product moves down the pan, each spray sequence is turned on.
- Once the pan is filled the rest process moves in a continuous manner.
- Utilizing a sensor to initiate the shutdown sequence and the product feeding stops.

Coated Tablet Evaluation

The following test are employed to check the coating quality.

- Adhesion test with tensile strength testers are used to measure the force needed to peel the film from the tablet surface.
- Tablet hardness tester is used to test diametric crushing strength of the coated tablets. The rate of disintegration and dissolution of coated tablet should be studied film defects due to temperature and humidity are verified, it can be studied by the stability of the coated tablet.
- By the film coting of the tablet provided relative information on the protection of

CONCLUSION

In recent years, Pharmaceutical formulation in Tablet coating gains remarkable development, efforts are there to ensure durability as well as to improve the quality of the finished product. Significant development and improvement of this technology regarding energy consumption, distribution of film, drying efficiency, has taken place. Still there is a lot of scope for betterment of coating technique in future. More work can be done to get better coating solvent, drying technique and spaying methods.

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