INDO AMERICAN JOURNAL OF PHARMACEUTICAL RESEARCH

OPTIMIZE THE PROCESS PARAMETERS OF ROLLER COMPACTION STABLE AND ROBUST DOSAGE FORM: A REVIEW

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ARTICLE INFO

Article history
Received 15/01/2020
Available online
31/01/2020

Keywords
Disintegrants Flowability,
Roll- Compaction,
Dry Granulation,
Process Parameter.

ABSTRACT

Roll compaction is a unit process in the dry compaction process; a force enhances a mass procedure in which granules are ready with suitable flowability, granulation properties, chemical stability and uniformity especially for heat sensitive and moisture formulations. Throughout the roll compaction process, the active ingredient and excipients of the dry powders, example lubricants, diluents, binders and disintegrants are mixed in the blender. The mixtures of powder are then roller granulated and reduces the size to make granules. The resultant granules are blended with lubricated and compressed into a tablet form. The current work was undertaken to prepare a stable and robust dosage form by optimizing the process parameters of roll- compaction. In roller compaction powder blend is first passed through feeding sector, then densified powder go through compaction sector between two counter rotary rolls and sheets are formed. Granules are passed through a suitable sieve and oversize & undersize granules are separated. New compaction cycle is performed if the suitable ratios of oversize and undersize granules are not achieved. Then these granules are blended and extragarnular substance is blended with previous blend. Blend is then subjected to compression for tablet preparation. Sheets are evaluated for their breaking force by using Universal Force Tester® FMT 310. A sheet piece of 10 x 10 mm was placed in the test plate and the upper stamp was driven down towards the sheet with 10 mm/min of speed and breaking force is measured. The tablets made from roll compacted granules were found to be superior quality and all test revealed that evaluation parameters were under pharmacopoeial limits. With technological advances in drug development, dry granulation by roller compaction is more advantageous than wet granulation process with simple manufacturing process, low operational cost, no use of liquid solvent, large scale production and suitability for heat and moisture sensitive drug. objectives of the review article are to optimize the process parameters (Roll Compaction), optimize the blending parameters, perform the blend uniformity, evaluate the in-process parameters, and perform the dissolution study.

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*Please cite this article in press as **Vikash Jakhmola** et al. Optimize the Process Parameters of Roller Compaction Stable and Robust Dosage Form: A Review. Indo American Journal of Pharmaceutical Research.2020:10(01).*

INTRODUCTION

Many ingredient of solid dosage form including drug substance and excipients are passed through numerous processes of developed and thus end with last result. Many industries use compaction methods to enhance and densify little powder particles into superior one that improve powder steady without separation so that the substance can be processed successfully and resourcefully into the hard quantity form. There are 2 methods of compaction one is wet compaction and another is dry or roll compaction. [1] Roll compaction is a unit process in the dry compaction process; a force enhances a mass procedure in which granules are ready with suitable flow ability, granulation properties, chemical stability and uniformity especially for heat sensitive and moisture formulations. [2] Throughout the roll compaction process, the active ingredient and excipients of the dry powders, example lubricants, diluents, binders and disintegrants are mixed in the blender. The mixtures of powder are then roller granulated and reduces the size to make granules. The resultant granules are blended with lubricated and compressed into a tablet form. During the roll compaction process, active ingredients and the excipients are mixed consistently to shape powder blended and is approved incessantly through the space between a couples of rotary compression rolls to make solid sheets. Many sheets are passed through a roller through the screen of appropriate mesh size to make dry granules. Dry granulation is frequently compiled with screw feeder, feed hopper feed hopper, 2 counter rotary rollers with equal diameter, flake grinder, and screen for milling process. Dry granulation by roller compaction has a variety of advantages such as ease of developed process, cost-advantages, simple scale up and great production yield. In dry granulation process, no liquid or drying process is involved so that it is most appropriate planed for heat sensitivity and moisture for drug formation. [3, 4] As compared to direct compression, dry granulation process can run more professionally with high drug loading, advance flow, and content consistency without substance separation. The objectives of the review article are to optimize the process parameters (Roll Compaction), optimize the blending parameters, perform the blend uniformity, evaluate the in-process parameters, and perform the dissolution study.

FORMULATION PLAN:

Development and formulation of the product Roller granulation is initiated with the physio-chemical properties of drug substance and other ingredients. Afterword's challenges are identified in the formulation development. Challenges with drug load, low flow, low compatibility, more compressibility, low density etc. appropriate variety of formulation active ingredient and other excipients will maintain the reduced physical properties of drug substance, therefore significantly develop the processiblity of the powder combination. Size improvement of fine particle by binding the particles is the vital part in dry granulation. [5] For dry granulation process variety of powder substance is very significant. Mixture of powder substance is based on the unit size and morphological appearance. There are two attribute of powder substance affects on the flow ability of granules and involuntary force of tablets. Dry granulation can be inappropriate but the substance is powerfully paste to outside the metal or non-squeezable. Also the strength of dry granulation is too reliant on the inconsistency of involuntary properties of active ingredients. The drug compaction capability can differ, depending on the quantity and active ingredients of mass properties. [6] In the roll compaction process API is sifted through the sieve and mixed with other ingredients in the suitable blender. The mixed substance is blended with the lubricant and the lubricated substance is transferred to the hopper, then it is passed through screw feeder. The feeding substance is approved through the counter-rotatry rolls and therefore feed substance gets compressed. After that the compressed sheets are crushed to form granules. The powder which receives inadequate force to form sheets is bypass into separate channel. The crushed granules are merged with extra granulated powder and lastly lubricated.

The recipients are based on subsequent situation:-[7]

i. Recipients must be chemically well-matched with drug substance.
ii. Recipients are supposed to meet the rigid necessities.
iii. Recipients ought to help to improve consistency, flow ability, density, compact ability, and adhesiveness.

Diluents

Diluents mostly ease formulation plan and API individuality as well as procedure development. Usually Mannitol, Microcrystalline cellulose (MCC), Lactose, Di-calcium phosphate (DCP) is used. Diluents plays a very important role in modify the pre-compaction blend property. Diluents help to inform consistency, compatibility, flow, and solidity to the blends and therefore ensuring high-quality sheets or sheets and granule. [8]

Binder [9-17]

Binder plays extremely significant role in compact powder, particle size distribution, potency of sheets as well as granules and tablet friability. Little binder attention decreases the power of granules and also elevated binder attention affect tablet disintegration and dissolution. Most usually used binders are Methylcellulose, Hydroxypropyl methylcellulose, Hydroxypropylcellulose.

Disintegrant

A disintegrant is used to smash tablets into granular form and more into the fine particles, and therefore helps to get acceptable disintegration time and dissolution rate. Suitable organize of sheet and granule porosity can direct to enhance disintegration competence. Cross Carmellose sodium, Sodium Starch Glycolate, Crosspovidone, starch etc are extensively used disintegrant.

Lubricant

Lubricant is usually necessary to progress flowability and to avoid devotion to the device surface for allowance the most reliable feed powders. For dry granulation, lubricants are used in both intra granularly and extra granularly portions. Meditation of lubricant and lubrication mixing time can influence the frictional properties of the concluding feed substance. Magnesium stearate is mainly usually used lubricant. Talc is the second the majority usually used lubricant.

Glidant

Glidant is additional to a great number of dry granulation formulations to advance the flow ability of pre compression powder. They do something as sphere bearings to decrease the friction in the middle of particles. e.g., Silicon dioxide.

EQUIPMENT AND PROCESS PARAMETERS:

In the procedure of manufactured goods growth, the formulations require to be evaluating on dryer compactor by development parameters engaged into consideration. Naturally, dryer rotator roller use in the pharmaceutical manufacturing unit is twice roll presses. As movable bulk powder approach the conclusion of hopper, particles are rearranged and densified. On this phase, the particles are uncovered to very little strength. The greatest force is achieved at the impartial nip angle, which characteristically is to some extent before the minimum roll gap. It is reported that the superior the squeezable force or the feeding rolling ratio, the additional peak force moves gone from the minimum roll gap. [17] The nip angle is the area where pre-compacted powders go into the nip area, which depends on the substance friction angle and the roll surface friction angle. Even as the nip angle is huge for willingly compressible substance, it is minute for incompressible substance. Following the roll gap, the sheets are extruded from the rolls, after that chopped and milled to make granules of required particle sizes.

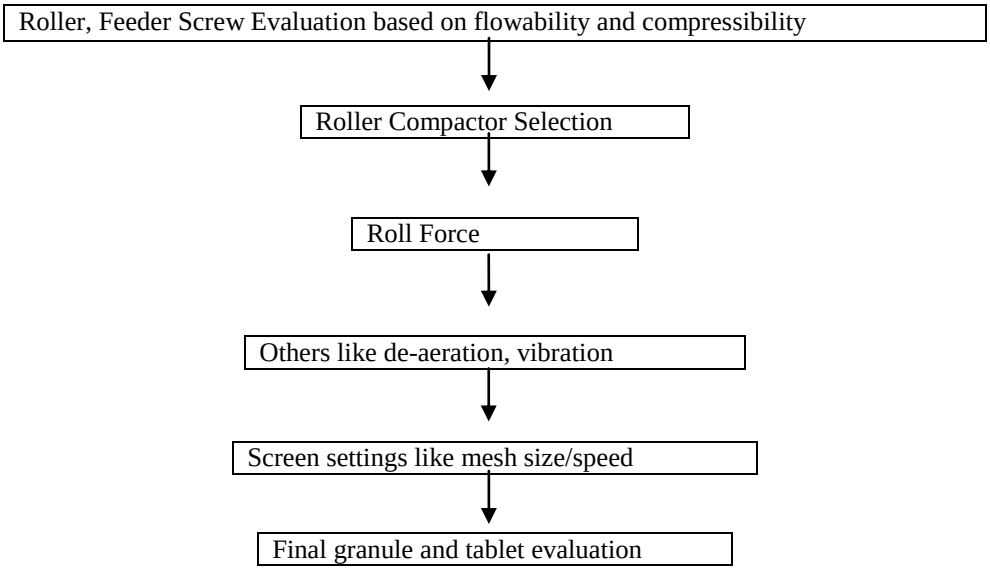

Fig: 1. Flow chart for apparatus variety and process parameters assessment.

ROLLER COMPACTION THEORY:

Dry granulation is an agglomeration method in which powder is compacted by passing from side to side two equal diameter counter rotary rollers. Mixture powder which is to be densified passed to roller from screw feeder with different mechanisms. As the powder is densified, it passes from side to side three different sections. The limits between the sections are definite by their sharp positions. [18,19]

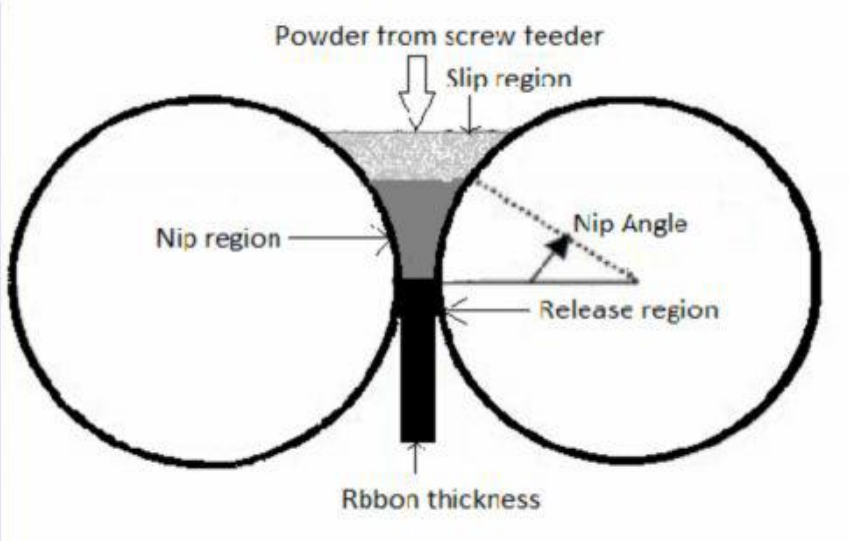

Fig: 2. Roller compaction Diagram.

Roller Compaction Process [20]

Slip section (feeding sector):

The slip section is the sector close to the feeding of the powders. The slip section is effectively related to wall friction and inters particle friction of the feed. Substance starts to move downward at a rate less than the surface speed causing the formulation "slips".

Nip section (compaction sector):

In the nip section, the substance is subjected to maximum stresses between two rolls leading to the formation of solid compact or sheet. In this section powder moves at the same speed as that of roll surface.

Extrusion section (The release section):

In release section there is great decrease in force as roll gap starts to enhance again as the compact is ejected and can expand due to elasticity. The compacted sheet exhibits relaxation as force is released from the rolls.

PLAN OF ROLLER COMPACTOR:

Plan of roller compaction consists roll plan, feeder system plan, plan of mills and other accessories. Quality of granule depends upon optimization of process parameter. [21,22]

Roller Unit:

Roller unit consist of two equal diameter counter rotary roller through which powder is passed and get compacted. Rollers create force on powder substance and converts into compacted sheet. Two types of rotary compactors are accessible according the character of the gap between two rotary, those two types are rotary compactor through a fixed gap arrangement and rotary compactor through variable gap system. In fixed gap system powder feed is prohibited by screw feeder and in variable gap system powder feed is prohibited by girth between rolls and screw feeder. Rollers are oriented on the machines in different ways and the plan of roller orientation varies from manufacturer to manufacturer.

Horizontal orientation:

It is most usually used orientation plan. In these plan rollers are arranged horizontally. Also it should be noted that the roller orientation defines feeder orientation as well. Usually in Horizontal orientation of rolls substance loss is high from bypass. Bypass occurs because substance may remain in nip section for certain, uncontrolled time period. E.g. Hosokawa Bepex GmbH, The Fitzpatrick Company, Freund Industrial Co.

Vertical orientation:

In vertical orientation direct bypass through rolls is minimized because substance movement is not governed by gravity feeding system. Due to the advantage of less bypass of substance, this vertical plan is preferred for low dose product. E.g. Alexanderwerk AG.

In-cline orientation (position between horizontal and vertical): Such type of plan reduces bypass of substance up to 10- 15 %. E.g. Gerteis Maschinen.

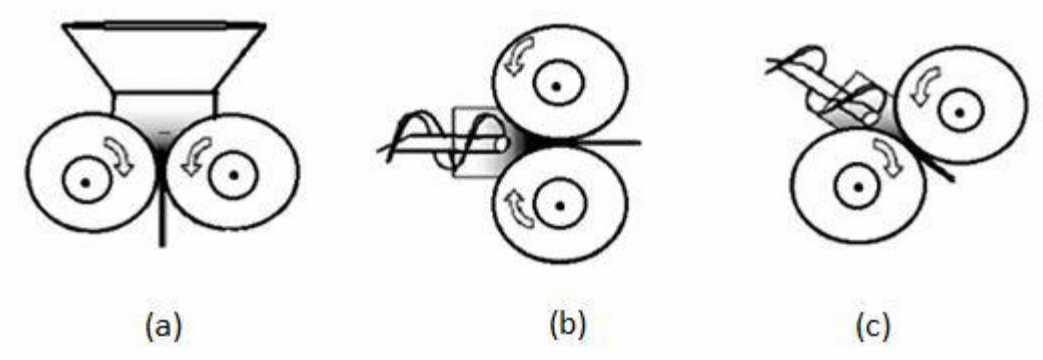

Fig: 3. Roller Orientation Diagram.

Feeder plan:

The feeder is confidential in to gravity feeder and force feeder. Into a gravity feeder, the feed flow manage is by use hopper without an outside energetic force to granulation sector and the powder is opaque and free curving gravity feed scheme can be used. In a force feeder, a rotary screw is installing in the middle of the hopper. There are 2 types of feeders, single screw feeder and another onr is double screw feeder. Screw feeding continually compacting and deaerates the blend.

Flake crusher:

Flake crusher is situated between roll and granulator. Compacted Sheet comes out and the roller is compressed by flake crusher and converts it into the smaller size pieces. Flake crusher improves substance flow by devastating of compressed sheet. The Flake Crusher is planned for dust free processing.

Milling or size reduction:

Milling is procedure in which the sheets shaped throughout compaction which is flattened by flake crusher to appearance different size granulated pieces. These dissimilar size pieces is necessary create consistent particle size by using suitable size screen. Dissimilar mill screen orifice size used might be unreliable with blend to blend for size decrease. Milling help to improves flow ability, content uniformity particle size distribution and decrease segregation.

Deaeration:

Air entrap throughout feeding of blend to the rollers can create the sheet weaker or brittle. Variety of proper feeder screw helps to get rid of air setup issue to convinced amount. To take away entrapped air deaeration scheme is from time to time used in the machines.

Feeder vibrator:

To preserve proper consistent incessant flow of feed substance powder particularly in case of a deprived flow powder, an easy gravity feeder and force feeder may not work to be good sufficient. Setting up of a feeder vibrator can be an simple and efficient way to recover the flow.

Temperature control:

The screw escape can produce a lot of warmth when rotary in the powder bed. In an extremely crowded powder bed, extreme heat may raise the limited temperature, and reason the powder to be partly melted and wedged to the flight.

IMPACT OF PROCESS PARAMETERS:

Dry granulation process parameters have very important belongings on the process viability, sheet superiority, granule flow ability and blend consistency. Compaction force, roll speed, screen size, feeder screw speed, and roll gap are the grave parameters desired to be optimized to advance product quality. Competence of dry granulation is based on the equipment plan and operating parameters. [23]

Compaction force:

Enough granulation force is necessary to densify the loose powder. Below force the powder gets densified and bonded to form Sheet. Growing roller force at certain limit enhances sheet density; granules mean particle size and flow ability. Optimum granulation force which gives good superiority granule might differ with mixture of substance.

Roll gap:

The distance between the rolls at their nearest point is the gap roll. This is the serious parameter of granulation and one that needs to be stabilized by the development parameters mention above. The function of force functional to the rolls and the amount of substance that is approved between them.

Screw speed:

Screw speed is a dangerous process parameter in the roller granulation. Most advantageous range of screw speed depends ahead powder substance flow, roller speed and the roller gap. When screw speed is low down, substance reaches in nip sector in inadequate quantity ensuing in to formation of sheets with low potency. High screw speed could cause a highly densified region in the nip area, and cause melting or caking of particles on the flight.

Roll speed:

Roll speed is inversely associated to reside time for particle granulation which affect sheet density. Roller speed desires to be used to in unity to feeder screw speed and flow of powder.

Milling:

Sheets size diminution can be done by applying force which result preferred size granules. Preferred granule size necessary for identical particle size distribution, good flow ability, compressibility. The mill screen orifice size straight impacts particle size distribution which can potentially impact granule consistency and flow ability.

PHYSICAL PROPERTY MEASUREMENTS: [24]

Relative density or Sheet Solid Fraction:

$$RD = ED / TD = 100 - n/100$$

Where RD = relative density, ED =envelope density, TD =true density, n =sample porosity.

The true density of granulated substances was firm using a helium pycnometer. The sachet density of each sheet sample was calculated by a GeoPyc® 1360 envelope density.

Sheet Tensile Strength:

Distinguish the involuntary potency of sheets by via Texture Analyzer can be a powerful tool. The tensile potency of the sheets was quantified by a three-point ray bending test using a texture analyzer via the following equation.

$$TS = 3 F L / 2 W T2$$

Where TD = tensile strength at fracture,F = force applied at fracture,W = width,T = thickness
L = gap distance between two supporting beams

A Texture Analyzer (TA) consists of a automatically stable structure, where a vertically variable arm, prepared with a load cell, applies definite force to the substance in investigation by means of variable tools. Tensile potency is defined as the smallest amount tensile stress necessary for fracture instigation within a compact.

Granule Particle Size Distribution:

The particle size distribution of powder mixture is calculated by using a particle size analyzer (Sympatec, Helos model). The analyzer is based on the laser diffraction opinion and it is a dry dimension method. Each sample was considered in triplicate and the average particle size distribution was calculated.

Granule Bulk and Tapped Density:

The bulk density, DB of granules was resolute by the granule weight filled into a 25 mL graduated cylinder. The tapped density, DT of granules was resolute by tapping the filled graduated cylinder for 1250 taps using a tap density tester and Carr's compressibility index (CI) of sheets was then intended.

Granule Flow Evaluation:

Flow properties of granules are assessed by means of an avalanche tester, angle of repose, shear cell testing that calculated the avalanche time distribution of tested powders plummeting inside a slowly rotary drum over a time period.

SCALE-UP:

Scale-up is generally defined as the process of increasing the batch size. Scale –up of a process can also be viewed as a procedure for applying the same process to different output volumes. There is a subtle difference between these two definitions: batch size enlargement does not always translate into a size of the processing volume. [25] In mixing application, scale-up is indeed concerned with increasing the dimensions from the laboratory to plant size. On the other hand, processes (e.g. tableting) exist for which "scale-up" simple means enlarging the output by increasing the speed.

Fig: 4. Flow Chart of Scale-up.

SCALE-UP THE GRANULATION PROCESS:

Today the production of pharmaceutical granules is still based on the batch concept.In the early stage of the development of a solid dosage form the batch size is small, e.g., for first clinical trials. In a later stage the size of the batch produced in the pharmaceutical production department may be up to a 100 times larger. Thus the scale-up process is an extremely important one. Unfortunately, in many cases the variety of the equipment involved does not facilitate the task of scale-up. During the scale-up process the quality of the granules may change.[19] A change in granule size distribution, final moisture content, friability, compressibility, and compactibility of the granules may strongly influence the properties of the final tablet, such as tablet hardness, tablet friability, disintegration time, dissolution rate of the active substance, and aging of the tablet.[26,27]

SCALE-UP AND MONITORING OF THE GRANULATION PROCESS:

Because the behavior of the wet granulation process cannot yet be described adequately by mathematical equations, the dimensionless groups have to be determined by a dimensional analysis. [28] For this reason the following idealized behavior of the granulation process in the high-speed mixer is assumed:

The particles are fluidized.

The interacting particles have similar physical properties.

There is only a short-range particle–particle interaction.

There is no system property equivalent to viscosity, i.e., (1) there are no long-range particle–particle interactions and (2) the viscosity of the dispersion medium air is negligible.

Scale-Up of the Granulating and Tableting Process:

A pharmaceutical tablet is a solid compact in any shape, containing drug and/or excipients, prepared from powder by the application of compressional force, and exhibiting some degree of strength. Compaction is the pharmaceutical unit operation of applying force or force to the powder to densify it and generate the physical bonds between the powder particles to create this strength. To consider the subject of scale-up of the granulation and tableting process, one must consider the production of one tablet in 30 minutes, a full-scale rotary tablet press at more than 2000 tablets per minute. The principles of compaction/compression are the same.

SCALE-UP OF COATING PROCESSES:

The characteristics of pharmaceutical coating processes sets them apart form most, if not all, other pharmaceutical unit operations, not only in terms of issues that need to be understood during process development, but also when it comes to scaling up those processes. This is especially true when dealing with the number of process variables that have to be considered. If coating processes are subdivided into pan and fluid bed processes, then for those specific types of processes that are routinely employed in the pharmaceutical industry today, it is valid to summarize these processes as belonging to two or three fundamental operating principles.

OPTIMIZATION:

Optimize is defined as "to make perfect". Optimization is an act, process, or methodology of making plan, system or decision as fully perfect, functional or as effective as possible. Optimization of a product or process is the determination of the experimental conditions resulting in its optimal performance. In Pharmacy word "optimization" is found in the literature referring to any study of formula. It is the process of finding the best way of using the existing resources while taking in to the account of all the factors that influences decisions in any experiment. [29]

OPTIMIZATION AND PRODUCTION:

Validation studies:

Production is implementing after validation studies that know how to confirm that process is able to steady the product based on transferred manufacturing formula. While the manufacturing department tolerant technology is accountable for validation, the research and development department transferring technology be supposed to take liability for validation such as presentation requirement, cleaning and process validation which are single to subject drugs.

Scale up for production:

Scale up involve the convey of technology all through the small scale development of the product and processes. It is necessary to judge the production environment and system throughout development of process. Different operations e.g. dispensing, blending, compaction or dry granulation or wet granulation, shifting compression, coating are worn in the formulation of solid dosage form. Effective technology conveys helps to offer process effectiveness and control and preserve product quality.

CONVENTIONAL OPTIMIZATION METHODS:

Hybrid Methods:

Hybrid methods combine the characteristics of different optimization methods. hybrid methods are most useful when they combine the best features of their components. One approach which has been in practice is a hybrid form of a GA and SA. The GA is used to maintain a pool of trial solutions and to generate offspring; the SA governs the selection part by accepting all improving.

Random Search:

Random search is not a strategy many people would use, unless there is no other alternative. Yet in some molecular mechanics software packages it is implemented to serve as a reference point for other optimization procedures. The strategy is simple: just keep on trying new candidate solutions and keep the best one(s) until the time is up.

Multivariate methods:

The development of modern analytical equipment provides the researcher with large quantities of data. Extracting useful information from the collected data becomes a new challenge for the researcher. Just looking at data tables or examining one variable at a time is not enough in most cases.

Multivariate Plan:

Multivariate plan, or experimental plan in principle properties as it is often referred to, is a combination of experimental plan and PCA. Instead of variables, principle properties are used in plan. This makes it possible to reduce the plan considerably and still obtain relevant information.Which variables influence tablet quality.

RECENT OPTIMIZATION METHODS:

Factorial Plan and Optimization:

Traditionally pharmaceutical formulations are developed by changing one variable at a time. The method is time consuming and it is difficult to evolve an ideal formulation using this classical technique since the combined effects of the independent variables are not considered (Baba et.al. 1989). It is therefore important to understand the complexity of pharmaceutical formulations by using established statistical tools such as factorial plan.

Global Optimization:

Global optimization is a bough of practical mathematics and arithmetical analysis that deal with the optimization of a purpose or a set of functions In real-life problems, functions of many variables have a large number of local minima and maxima.

EVALUATION OF PRE-FORMULATION STUDIES: [30]

Preformulation study:

I) Pre-compression evaluation parameters:

a) Angle of repose. b) Bulk density. c) Tapped density. d) Hausner'sratio. e) Compressibility index (%).

II) Drug polymer interaction study:

a) FTIR studies. b) DSC studies.

Pre compression evaluation parameters:

Micromeritic properties:

Angle of Repose (θ):

The frictional strength in a movable powder or granules can be determined through the angle of repose and that is the most angles possible among the outside of a quantity of powder or granule and the flat plane.

$$\tan\theta = h/r \quad (\theta = \tan^{-1}(h/r))$$

Where, θ = angle of repose, h = height, r = radius.

Method: A funnel was filled to the brim and the test sample was allowed to flow smoothly through the orifice under gravity. From the cone formed on a graph sheet was taken to measure the area of pile, there by evaluating the flow ability of the granules. Height ofthepilewas also measured.

Bulk Density:

Bulk density is defined as the mass of a powder divided by the bulk volume. The bulk density of a powder depends primarily on particle size distribution, particle shape and the tendency of the particles to adhere to one another.

Method: Together Loose Bulk Density (LBD) and Tapped Bulk Density (TBD) were determined. A quantity of accurately weighed powder (bulk) from each formula, previously surprised to break some agglomerates shaped was introduced into a 25ml measuring cylinder. After the early quantity was experiential, the cylinder was allowable to drop below it's possess weight on to a solid outside from the height of 2.5cm at 2 sec interval. The taping was sustained pending no additional alter in amount was noted.

LBD (Loose Bulk Density) = Weight of the Powder/Volume of Packing

TBD (Tapped Bulk Density) =Weight of the Powder/ Tapped Volume of Packing

Tapped density:

The measuring cylinder containing a known mass of blend was tapped for a fixed time. The minimum volume (Vt) occupied in the cylinder and the weight (M) of the blend was measured. The tapped density (λt) was calculated using thefollowing formula t = m/v

Hausner's ratio:

Hausner's ratio is a not direct catalog of ease of powder flow. It is measured through the following method

Hausner's ratio = t/d

Where t = tapped density, d = bulk density

Lower H (<1.25) indicate improved flow property than superior ones (>1.25)

Percentage Compressibility:

Percentage compressibility of mixed powder was determined by Carr's compressibility index calculated by following formula.

Carr's Index % = TBD – LBD/TBD x 100

Where, LBD = Loose Bulk Density, TBD = Tapped Bulk Density.

ROLL COMPACTION: [31]

Roll compaction sequence:

Original premix (drug and intragranular substance)

⇩

Roll compaction

⇩

Milling of sheets

⇩

Separation of oversize and undersize granules

⇩

Blending of oversize and undersize granules

⇩

Compression

EVALUATION OF THE TABLET PROPERTIES:

Tablets were subjected to evaluation of properties including drug content uniformity, weight variation, tablet hardness, friability, and thickness, and in-vitro drug release with different media.

Weight variation:

The tablet weight being complete was regularly determined to make sure that tablets contain the appropriate quantity of drug. The USP weight difference test is done by weighing 20 tablets separately, the average weight calculated and the individual weight compared to the average weight. The tablets meet the USP requirement that not supplementary than 2 tablets are exterior the proportion limits and no tablet differ through more than 2 times the proportion limit. USP official limits of percentage deviation of tablet are presented in the Table.

Table: 1. Weight variation limits.

Sr. No.	Average weight of tablet (mg)	Maximum % difference allowed
1	130 or less	10
2	130-324	7.5
3	324<or more	5

Tablet hardness:

The confrontation of tablets to delivery or under breakage condition of the storage, carrying and handling earlier than custom depends on its rigidity. The rigidity of each lot of tablet was checked by using the apparatus (Monsanto hardness tester). The rigidity was calculated in conditions of kg/cm^2. 3 tablets were chosen at random and tested for rigidity. The standard rigidity of 3 determinations was recorded.

Friability:

Friability usually refers to weight loss of the tablets in the containers outstanding to elimination of fine from the tablet exterior. Friability usually reflects deprived consistency of tablet ingredients.

Method:

20 tablets were weighing and the weight of these tablets was recorded and placed in apparatus (Roche friabilator) and rotate at the velocity of 25 rpm for 100 revolutions and then tablets were detached from the apparatus, dusted rancid the fines and weighed again. The recorded the weight.

$$\% \text{ Friability} = \frac{\text{Initial Wt. of tablet - Final Wt. of Tablet}}{\text{Initial Wt. of tablet}} \times 100$$

Tablet thickness:

Thickness of the tablet is important for uniformity of tablet size. Thickness was measured using Vernier Calipers. It was determined by checking the thickness of ten tablets of each formulation.

Content Uniformity:

The tablets were tested for their drug content uniformity. At random 20 tablets were weighed and powdered. The powder equivalent to 500 mg was weighed accurately and dissolved in 100ml of phosphate buffer of pH 6.8. The solution was shaken thoroughly. The undissolved matter was removed by filtration through Whattman's filter paper No.41. Then the serial dilutions were carried out. The absorbance of the diluted solutions was measured at 263 nm. The concentration of the drug was computed from the standard curve of the RC in phosphate buffer of pH 6.8.

Disintegration time:

Tablet disintegration is an important step in drug absorption. The test for disintegration was carried out in Electro Lab USP disintegration test equipment. It contains 6 glass tubes which are 3 inches extended, open at the top, and held against a 10 mesh screen, at the bottom end of the basket rack assembly. To test the disintegration time of tablets, one tablet was placed in each tube and the basket rack was positioned in a 1 liter beaker containing pH 1.2 Buffer solution at 37°C ± 1°C such that the tablet remains 2.5 cm under the outside of the liquid. The disintegration time of the tablet was noted.

In-vitro Dissolution time:

In-vitro dissolution studied of center and encrusted drug of HMG-COA reductase inhibitor was carried out using Electro lab TDT-08L USP dissolution test equipment. The particulars be known as below:

Electro lab TDT-08L USP dissolution test apparatus:

Medium: pH 1.2 buffer solution and pH 6.8 buffer solution, RPM: 50
Time: 2hrs in pH 1.2 followed by dissolution in pH 6.8 buffer solutions.

Procedure:

Tablet was introduced into the basket of the Electro Lab TDT-08L USP dissolution test equipment and the equipment was put in activity, 5 ml of test was reserved for 1st half hour at 10 min intervals and after that at 15min intervals and replace by the personal buffer solution. Reserved sample are analyze through UV spectrophotometer for presence of drug using buffer solution as blank.

CONCLUSION

With technological advances in drug development, dry granulation by roller compaction is more advantageous than wet granulation process with simple manufacturing process, low operational cost, no use of liquid solvent, large scale production and suitability for heat and moisture sensitive drug. Selection of drug and excipient for roller compaction is based on their physical and chemical attributes.Selection of formulation design and process parameter play vital role in roller compaction.Optimization of process parameters such as compression force, roll speed, roll gap, screw speed, milling speed, and milling screen orifice size is essential and critical in roller compaction. Roller compression affects particles size distribution, flowability, homogeneity, compressibility, compactability of active pharmaceutical ingredients, and such parameters can inturn affect dissolution profile, disintegration time, hardness and other post compression parameter of tablets.

ACKNOWLEDGEMENTS

Authors are special thanks to Sri. Sardar Raja Singh Sir, Chairman and Mrs. Lata Gupta Madam, Director Admin, GRD (PG) Institute of Management and Technology, Dehradun, providing the facilities to publish this research work.

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