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Review on bilayer tablet

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INTRODUCTION:

Bilayer Tablet is the novel technology for the development of controlled release Formulation. Developing a combination of two or more Active Pharmaceutical Ingredients (API) in a single dosage form is known as a bilayer tablet. We have proposed a bilayer tablet, in which the one layer is formulated to obtain immediate release of the drug. The second layer is an controlled hydrophilic matrix. Pharmacological therapies either require or benefit from the administration of drugs in a sequential manner. Bilayer formulations carry more than one drug and deliver each of them without any pharmacokinetic or dynamic interactions, with their individual rate of delivery (immediate, timed or sustained).Bilayer tablet technology is improved beneficial technology to overcome the shortcoming of the single layered tablet. Bilayer tablet is the newer Dosage form for the successful development of controlled release formulation and better than the traditionally used dosage forms. Oral route is the most commonly employed route of drug administration. Although different route of administration is used for the delivery of drugs, oral route remains the preferred mode. The popularity of the oral route is attributed patient acceptance, ease of administration, accurate dosing,method and generally improved shelf-life of the product

General Properties of Bi-Layer Tablet Dosage Forms

1.A bi-layer tablet should have elegant product identity while free of defects like chips, cracks, discoloration, and contamination.

2 have sufficient strength to withstand mechanical shock during its production packaging, dispense.

Need bilayer tablets[1,2,3,]:

1.Controlling the delivery rate of either single or two different active API'S.

2.To modify the total surface available for API. layer either by sandwiching with one or two in active layers in order to achieve swellable/erodible barriers for modified release.

3.To separate incompatible Active pharmaceutical ingredient (APIs) from each other, to control the release of API from one layer by utilizing the functional property of the other layer (such as, osmotic property)

4.For the administration of fixed dose combination of different API prolong the drug product life cycle buccal/mucoadhesive delivery system; fabricate novel drug delivery systems such as chewing device and floating tablets for gastro-retentive drug delivery.

ADVANTAGES AND DISADVANTAGES [4,5,6]

Advantages:

1.They are used as an extension of a conventional technology.

2.Patient compliance is improved because fewer daily doses are required compared to traditional delivery system.

3. Maintain physical and chemical stability.

4.Retain potency and ensure dose accuracy

5. Potential use of single entity feed granules.

6.They are a unit dosage form and offer the greatest capabilities of all oral dosage forms for the greatest dose precision and the least content variability.

7.Easy to swallow with less tendency to hang-up.

8. Suitable for large scale production.

Disadvantages

1.Cross contamination between the layers.

2.Insufficient hardness, layer separation, reduced yield.

3.Inaccurate individual layer weight control.

4.Adds complexity and bilayer rotary presses are expensive.

5.Some drugs resist compression into dense compacts, owing to amorphous nature, low density character.

6.Drugs with poor wetting, slow dissolution properties, optimum absorption high in GIT may be difficult to formulate or manufacture as a tablet that will still provide adequate or full drug bioavailability.

IDEAL CHARACTERISTICS[7] :

1 It should be elegant & free from chipping, cracking, discoloration and contamination.

2 It ought to have adequate quality to with stand mechanical shock during its tablet formulation process.

3.A bi-layer tablet should have elegant product identity while free of defects like chips, cracks, discoloration, and contamination.

4.Should have sufficient strength to withstand mechanical shock during its production packaging, shipping and dispensing.

APPLICATION[8]

1 Bilayer tablet is improved beneficial technology to overcome the short coming of the single layer tablet

2.Separate two incompatible substances.

3.Bilayer tablet is suitable for sequential release of two drug in combination.

4.Sustained release tablet in which one layer is immediate release as initial dose and second layer is maintenance dose.

CHALLENGES IN BILAYER MANUFACTURING[9,10]

Conceptually, bilayer tablets can be seen as two single-layer tablets compressed into one. In Practice, there are some manufacturing challenges.

Delamination

Tablet falls apart when the two halves of the tablet do not bond completely.

The two granulations should adhere when compressed.

Cross-contamination

When the granulation of the first layer intermingles with the granulation of the second layer or vice versa, cross-contamination occurs.

It may conquer the very purpose of the bilayer tablet. Proper dust collection goes a long way toward preventing cross contamination.

Production yields

To prevent cross contamination, dust collection is required which leads to losses. Thus, bilayer tablets have lower yields than single-layer tablets.

Cost

Bilayer tableting is more expensive than single layer tableting for several reasons. First, the tablet press costs more. Second, the press generally runs more slowly in bilayer mode. Third, development of two compatible granulations is must, which means more time spent on formulation development, analysis and validation. These factors, if not well controlled/optimized, in one way or another will impact the bilayer compression per se and the quality attributes of the bilayer tablets (sufficient mechanical strength to maintain its integrity and individual layer weight control). Therefore, it is critical to obtain an insight into the root causes to enable design of a robust product and process.

MANUFACTURE OF MULTILAYER TABLETS [11-14]

The manufacture of multilayer tablets has been successful for over 50 years. New machine designs developed during the late 60s have made it possible to check the weight of individual layers by sampling without stopping the machine, providing in-process control facilities to ensure correct dosing . However, despite this, a considerable amount of expertise is still required to formulate these tablets and to ensure consistent manufacture to satisfy regulatory requirements .One problem that causes great concern is the delamination of layered tablets , which has become a more obvious problem with the increase in compression speed on modern high-speed rotary machines. The formulations used for each individual layer should be compressible and compactable on their own i.e. they should show satisfactory reduction in volume and form mechanically strong, coherent solid bodies. Under this assumption the interface between the layers should weld together during compaction and strong adhesion forces should hold the layers together after tablet ejection. However, this is not always the case, and as compressibility and compactability . of the individual layers should not be the cause for delamination, other physical mechanisms need to be identified that can explain the problems with delamination that have hampered recent developments of layered tablets.

Bilayer tablets are prepared with one layer of drug for immediate release with the second layer designed to release drug later, either as a second dose or in an extended release form. The bilayer tablets with two incompatible drugs can also be prepared by compressing separate layers of each drug so as to minimize area of contact between two layers. An additional intermediate layer of inert material may also be included. To produce adequate tablet formulation, certain requirements such as sufficient mechanical strength and desired drug release profile must be met. At times, this may be difficult task for formulator to achieve these conditions especially in bilayer tablet formulation where double compression technique is involved, because of poor flow and compatibility characteristic of the drug which will result in capping.

TYPE OF BILAYER TABLETS[15]

- ❖ Single side tablet press
- ❖ Double sided tablet press
- ❖ Bilayer tablet press with displacement monitoring
- ❖ Multilayer Compression Basics Presses

1.Single side tablet press.

The simplest design is a single sided press with both chambers of the doublet feeder separated from each other. Each chamber is gravity or forced fed with different powers, thus producing the two individual layers of the tablets. When the die passes under the feeder, it is at first loaded with the first layer powder followed by the second layer powder. Then the entire tablet is compressed in one or two steps.

Limitations

- No weight monitoring or control of the individual layers.
- No distinct visual separation between the 2 lyers.
- Dwell time due to the small compression roller possible resulting in poor deaeration capping and hardness problems.

2.Double sided tablet press

Most double sided tablet presses with automated production control use compression force to monitor and control tablet weight. The effective peak compression force exerted on each individual tablet or layer is measured by the control system at the main compression of the layer. This measured peak compression force is the signal used by the control system to reject out of tolerance tablets and correct the die fill depth when required.

Limitations

Correct bonding is only obtained when the first layer is compressed at a low compression force so that this layer can still interact with the second layer during a final compression. Bonding is too restricted if the first layer is compressed at a high compression force. The low compression force.

3.BILAYER TABLET PRESS WITH DISPLACEMENT MONITORING

The displacement tablet weight control principle is fundamentally different from the principle based upon compression force. When measuring displacement, the control. System sensitivity does not depend on the tablet weight but depends on the applied pre-compression force.

4. Multilayer Compression Basics Presses

can be designed specifically for multilayer compression or a standard double press can be converted for multipliers. The multilayer tablet concept has been long utilized to develop sustained release formulations such tablets have fast releasing layer and may contain players or triple layers to sustain the drug release from the tablet. The pharmacokinetics advantage relies on the fact that drug release from fast releasing granules leads to sudden rise in blood concentration, however the blood level is maintained at a steady state as the drug is released.

VARIOUS APPROACHES OF BILAYER TABLETS[16,17]

1.Floating drug delivery system These are designed to have a low density and thus float on gastric contents after administration until the system either disintegrates or the device absorbs fluid to the point where its density is such that it loses buoyancy and can pass more easily from the stomach with a wave of Motility responsible for gastric emptying. The bilayer tablet is designed in such a manner that, one layer gives the immediate dosing of the drug which gives faster onset of action while another layer is designed as a floating layer which floats in the stomach.

2.Polymeric Bioadhesive System

These are designed to imbibe fluid following administration, such that the outer layer becomes a viscous, tacky material that adheres to the gastric mucosa/mucus layer. This should encourage gastric retention until the adhesive forces are weakened. These are prepared as one layer with immediate dosing and other layer with bioadhesive property.

3.Swelling

System These are designed to be sufficiently small on administration so as not to make ingestion of the dosage form difficult. On ingestion they rapidly swell or disintegrate or unfold to a size that precludes passage through the pylorus until after drug release has progressed to a required degree Gradual erosion of the system or its breakdown into smaller particles enables it to leave the stomach. The simple bilayer tablet may contain an immediate release layer with the other layer as extended release or conventional release.

VARIOUS STEPS INVOLVED IN THE BILAYER TABLET FORMULATION ARE AS FOLLOWS [14,15,16] ❖ Filling of first layer

❖ Compression of first layer

❖ Ejection of upper punch

❖ Filling of second layer

❖ Compression of second layer

❖ Ejected fully bilayer tablet

EVALUATION OF BILAYER TABLETS [17,18]

GENERAL APPEARANCE

The general appearance of tablets is visual identity and overall elegance is essential for consumer acceptance for the production process.

SIZE AND SHAPE

The shape and dimensions of compressed tablets are determined by the type routing during the compression process.

THICKNESS AND DIAMETER

The diameter of the tablets is determined. Thickness and diameter of tablets were important for uniformity of tablet size. Thickness and diameter were measured using venire caliper.

WEIGHT VARIATION TEST

For weight variation test, twenty tablets are selected randomly, and the average weight is calculated there after the weight variance is calculated and weight variation is compared with IP standard. Twenty tablets were selected at random and the average weight was calculated. Weight Variation was calculated and was compared with I. P. standards (Singh and Kim., 2000).

FRIABILITY

Friability

will be measured by taking randomly 10 tablet which is weighed and placed in a friabulator and rotated at 25 rpm for a period of 4 minutes after resolution the tablets can be dusted and weighed. Friability is the measure of tablet strength.

QUALITY AND GMP-REQUIREMENTS[19,20]

- To produce a quality bi-layer tablet, in a validated and GMP-way, it is important that the selected press is capable of
- Preventing capping, separation of the two individual layers that constitute the bi-layer tablet.
- Providing sufficient tablet hardness.
- Preventing cross-contamination between the two layers.
- Producing a clear visual separation between the two layers.
- High yield.
- Accurate and individual weight control of the two layers these requirements seem obvious but are not as easily accomplished.

LITERATURE REVIEW OF BILAYER TABLETS

M. Namrata et al :A Review on Bi-layer Tablets,International Journal of Pharmaceutical and Phytopharmacological Research

Verma Rameshwar et al : bi-layer tablets for various drugs: A review, Scholars Academic Journal of Pharmacy (SAJP)

CONCLUSION

Bilayer layer tablets have been consist of two layers which is slow release and immediate release layer proposed a bilayer tablet, in which the one layer is formulating to obtain immediate release of the drug, with the aim of reaching a high serum concentration in a short period of time. The second layer is a controlling release hydrophilic matrix, which is designing to maintain an effective plasma level for a prolonged period of time.

Bilayer Tablets often an excellent opportunity for manufacturers to separate themselves from their competitors, improve their products efficacy and protect against impersonator product. Bilayer layer tablets have been consisting of two layers which is slow release and immediate release of the drug, with the aim of reaching a sign serum concentration in a short period of time. Now a day,s bilayer tablets are prepared. Bilayer tablet is improved beneficial technology to overcome the shortcoming of the single layered tablet. There is various application of the bi-layer tablet it consists of monolithic partially coated or multi layered Matrices. Bilayer tablet is suitable for sequential release of two drugs in combination, separate two incompatible substances and also for sustained release tablet in which one Layer is immediate release as initial dose and second layer is maintenance dose. The preparation of tablets in the form of multi layers is used to provide systems for the administration of drugs, which are incompatible and to provide controlled release tablet preparations by providing surrounding or multiple swelling layers. Bilayer tablet quality and GMP-requirements can vary widely.

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