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A Updated Review: Brief Overview on Bilayered Tablets and Its Introduction

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ABSTRACT

Bilayer tablets, prescribed for combining two medications in a single dose to enhance treatment efficacy, pose production challenges addressed in this review. It discusses difficulties encountered in production and offers potential solutions. Furthermore, it explores different styles like single-side applications, benefits, and drawbacks of bilayer tablet displacement presses, as well as double side presses, alongside comparisons with other tablet types to aid comprehension. Various procedures and methods employed in bilayer tablet production are also examined. Finally, the review concludes with a critical analysis of the discussed content.

Keywords: *Bilayered Tablets, APIs, active pharmaceutical Ingredients*

INTRODUCTION

Many countries, both developed and developing, are shifting their focus towards the treatment of various chronic illnesses and disorders such as hypertension, diabetes, and cardiovascular diseases. [2,3] A significant portion of medications for these conditions are taken orally, indicating a global preference for this administration route. The main objective of controlled drug delivery is to reduce the frequency of dosing. Modified release formulations aim to optimize treatment regimens by providing delayed and continuous drug delivery, improving patient adherence and comfort. Bilayer tablets, a newer and more efficient option, allow for sequential release of multiple medications or sustained release of a single medication. [4,5] They typically consist of layers for immediate and sustained release, with the former providing the initial dose. This design often incorporates super disintegrates to accelerate drug release for immediate effect, followed by gradual release for maintenance therapy. The sustained release phase is particularly useful for achieving rapid relief and reducing the need for frequent dosing. Various medications, including coronary vasodilators, antihypertensive, analgesics, and antipyretics, are suitable for this type of drug delivery. Some bilayer tablets feature dual sustained release layers on both sides, such as certain anti-diabetic medications. [6,7]

NEED OF BILAYER TABLETS [9-10]

• To administer set doses of combinations of several APIs [13], continue The Drug Product lifecycle creates novel drug delivery systems, including chewing devices and floating tablets for gastrointestinal medication absorption.

• Regulating the rate at which one or two active APIs are delivered.

• To change the total surface area available for the API layer by adding one or two inactive layers of sand in order to create erodible or Swellable barriers for modified release.

• To separate suitable active pharmaceutical ingredients (APIs) from one another, and to regulate the release of API from one layer by making use of the functional property of the other layer.

CHALLENGES IN THE FORMATION OF BILAYER TABLETS

The challenges associated with the mechanical properties of drug delivery mediums, particularly in solid dose delivery design, are multifaceted. Key issues include inadequate adhesion between compacted layers leading to interfacial cracks and subsequent delamination during storage or shipping. Additionally, variations in layer stiffness, sequence order, weight ratio, and cross-contamination pose significant hurdles in achieving consistent mechanical integrity. Without proper control over these factors, bilayer compression may suffer, impacting the tablets' overall strength and individual layer weight control. To address these challenges effectively, a comprehensive understanding of root causes and careful consideration of compression parameters and layer properties are essential for successful bilayer tablet development. [11'12]

ADVANTAGES OF THE BILAYER TABLETS

• Bi-Layer execution with an optional kit for switching to a single layer.

• In comparison to all other oral dose forms, the price is lower.

• Highest microbiological and chemical stability all oral dose types combined.

• The application of a coating technique helps hide objectionable odours and harsh tastes.

• Flexible Idea.

• They are a unit dosage form and have the most precise dose delivery and lowest content variability of any oral dosage form.

• Less likely to hang up and easy to swallow.

• Very suited for mass production.

PREPARATION OF BILAYER TABLETS:

There are three different varieties of bilayer tablets, each with a unique production technique. The first variety is the most basic design, known as It is created with a straightforward pressing technique using either force or gravity, depending on the situation. The second type is referred to as a double-sided press, which is formed through compression, and the final type is a bilayer tablet press, which is created through displacement. [44] The following describes each of the three types:

1) Single Sides Press

The single-sided press, known for its straightforward design, incorporates distinct compartments for the doublet feeder. Each chamber is responsible for producing separate tablet layers, achieved through either forced feeding or gravitational methods. [13] After passing beneath the feeder, the first layer receives the medication powder, followed by the second layer. Subsequently, one or two processes are employed to connect the entire tablet. To reduce the risk of layer separation, the tablet films partially mix at their interface as they traverse the die, establishing a robust bond between the two layers.

Limitations of single-sided press

1. There is no available control mechanism for the separate levels.
2. The layers are not visually separated from each other.
3. Due to the first layer's short dwell period, capping and de-aeration issues arise.
4. Lack of weight monitoring and management for the two distinct Strata.

2) Dwell Time

The term "dwell time" describes the period of time when the compression force is more than 90% of its maximum value. High-quality tablets are produced when long dwell periods are used, especially when compressing a complicated composition. [14]

3) Compression Force

The majority of bilayer formulations require the first layer's compression force to be less than 100 daN in order to maintain their capacity to bond with the second layer because it could deteriorate over this value. Reduced hardness of the Tablet is caused by poor bonding between the layers. Moreover, the layers eventually separate from one another. [15,16]

4) Double-Sided Tablet Press

This particular sort of bilayer pill has a core compression for every film as well as a separate fill station. The Bilayer tablet goes through four distinct steps before being ejected through the press. The majority of double-sided tablet presses with automatic production control monitor and regulate tablet weight using compression force. [17,18] The control system calculates the effective peak compression force that is applied to each tablet or tablet layer at the main layer compression. The control system will then use this peak compression force as a signal to reject any tablets that are outside of tolerance and adjust the filling depth of the die as needed. Double- sided tablets offer superior weight monitoring and individually manage the mass of each Layer in compared to single-sided tablets. By applying modest compression to the first layer, they also avoid capping. They have longer dwell times for sufficient hardness, but these qualities come with restrictions. [19]

• LIMITATIONS OF DOUBLE-SIDED TABLET PRESS

Because the two layers don't interact enough with one another and the first layer receives insufficient compression, there is a weak link between the two layers. Low compression force is another factor contributing to weight monitoring accuracy. [50]

BILAYER TABLET PRESS WITH DISPLACEMENT

Displacement control principles for tablets are distinct from those that depend on compressive force. The applied pre-compression force, not the tablet weight, determines the control system sensitivity when measuring displacement. [21] Hence, the pre-compression force is reduced to improve the monitoring process, which will improve the bonding between the first and second layers. [22,23] The upper pre-compression roller and lower pre-compression roller are the two compressors that make up the bilayer tablet press. The former is attached to an air piston, while the latter controls the compression height and is mounted on a yoke. [24–25]

EVALUATION OF BILAYER TABLETS

1. General Appearance

Customers' adoption of a tablet depends on a variety of elements, such as its overall style, visual identity, and general appearance. Tablets come in a variety of shapes, sizes, colours, scents (or no odour), tastes, surface textures, physical faults, consistencies, and markings that serve as identifiers. The dimensions of a tablet can be specified, managed, and monitored. [27,28]

2. Tablet Thickness

The thickness of a tablet is one of its key visual characteristics. Some of the filling machinery counts by using uniform tablet thickness. For this, the thickness of ten tablets is recorded by using vernier caliper in mm. [31-32]

3. Friability

Shock and friction are two of the main factors that shatter or chip the tablets. The friability test evaluates a tablet's ability to withstand these forces during packaging, handling, and shipping. It is directly related to how hard the tablet is. The Roche Friabilator is typically used to calculate friability. A predetermined number of tablets are weighed and placed within the device, where they are continually rolled and shocked, falling 6 inches per each rotation of the device. [35,36] The Tablets are weighed again and compared to the initial weight measurement after 100 of these spins, or roughly four minutes. The tablet's friability is defined as the difference. The percentage used to represent this value. Tablets With weight loss of 1% at most after the friability test are normally Accepted and the damaged or broken tablets are left and not picked up. Values of friability are not typically measured during capping. While a thin tablet with a wider diameter typically has more capping, a thicker tablet may have fewer capping tendencies. According to this, tablets with greater thickness experience less internal stress. [38]

4. Hardness

The hardness, which is now also referred to as the crushing strength determination, is set while the tablet is being made and aids in identifying when pressure adjustment on the apparatus is necessary. If a tablet is overly soft, it may not be able to withstand abrasion during future procedures like coating, packaging, or shipping, whereas an overly hard tablet may not break in the time necessary to meet the dissolving standards. The minimum strength that can break acceptable tablets is thought to be 4 kg. The force needed for tablet breakage is expressed in kg. Chewable and hypodermic tablets typically have less hardness—3 kg than oral tablets, which typically range from 4 to 10 kg in hardness. Some sustained-release tablets, on the other hand, have a harder hardness of 10 to 20 kg. The density and porosity of a tablet, for example, are strongly correlated with its hardness. The types of tablets have the biggest differences. It also depends on the tablet's shape, binding agent, chemical makeup, and compression pressure. [39-40]

5. Stability Study

The bilayer tablets are maintained under the following conditions for the duration specified by the ICH Guideline for expedited investigations after being packaged in appropriate packaging. After 15 days, the tablets were removed and examined for physical characteristics including visual flaws, hardness, friability, and drug content. To ascertain the kinetics of degradation, the acquired data is first fitted into the equations. To calculate the shelf life at 25°C, accelerated stability data are shown using the Arrhenius equation. [61-42]

CONCLUSION

The advanced technology of the bilayer tablet helps to overcome the downsides of the single-layered tablet. The bilayer tablet has numerous uses and is made up of monolithic, incompletely carpeted, or multi-layered matrices. A bilayer tablet can be used to insulate two inharmonious substances, release two medicines successionally, or produce a sustained release tablet where the first subcase is an immediate release original cure and the alternate subcase is a conservation cure. By creating girding or multitudinous swelling layers, multilayer tablet medications can be used to produce control release tablet medications and styles for the administration of inharmonious specifics. Quality and GMP conditions for bilayer tablets can vary greatly. This explains why there are multitudinous kind of presses being.

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